SAGEM-LINK F

Microwave Radio Links

7 GHz – 38 GHz

Installation and

Operation Manual

288 055 571-01

June 2004 Issue

SAGEM

SAGEM-LINK F
INSTALLATION AND OPERATION MANUAL

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Chapter 1

Installation

1.1 - Overview

This chapter explains how to install and set up SAGEM LINK F radio links. The main topics covered are :

- Unpacking the Equipment
- IDU installation
- Antenna installation
- ODU installation
- IDU to ODU Coaxial cable installation
- Powering up the system
- Antenna alignment
- Connecting IDU to external equipments

1.2 - Unpacking the Equipment

Verify that the items received are compliant with the packing list.

If any part of the equipment is damaged, contact Sagem representative for repair or replacement instructions.

The IDU and ODU are packaged in two separate boxes. In addition, the optional items are packaged in a separate container.

The IDU box contains, the IDU with cable interface module (one for 1+0 systems, two for 1+1 systems), the DC Power supply cable and a CDROM including the user manual and the SAGEM LINK F Pilot software.

The ODU box contains only one ODU.

Save case and shipping material, in case the equipment has to be returned.

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1.3 - IDU Installation

To install the IDU in a 19-inch rack :

- Attach the IDU in the 19-inch rack using four 6x12 stainless steel hex screws and washers into the corresponding rack cage nuts. This attachment grounds the IDU to the earth.

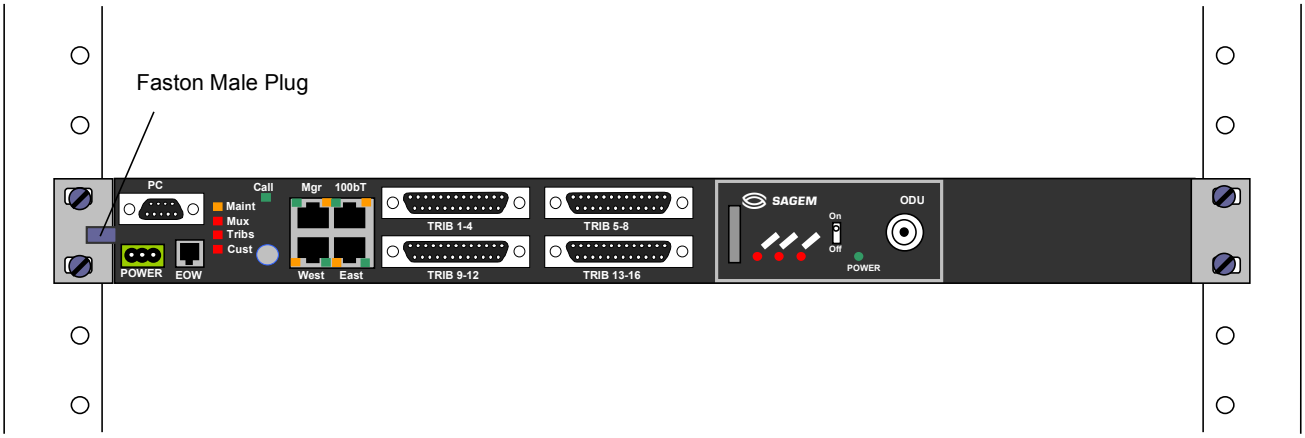

Figure 1.1 - IDU installation

- An additional grounding is possible by the use of a Faston plug (left side of the IDU). Use a 6 mm^2 section cable (minimum length required).

NOTE: When more than one IDU are to be mounted in the rack, it is recommended to keep a gap of 1 unit between two IDUs.

1.4 - Antenna Installation

Three types of antenna with several diameters are available for SAGEM LINK F radios.

- **Integrated antenna with Sagem Link F ODU interface** (0.3m, 0.6m, 0.9m, 1.2m or 1.8m diameter). With these antennas, the ODU is directly attached on the antenna. In some protected configuration using a coupler, the coupler is attached to the antenna, and the ODU are attached on the coupler.
- **External antenna with standard rectangular waveguide flange**, which is connected to the SAGEM LINK F ODU with a flex guide.
- **External antenna with two access** (dual polarized antenna) connected by two flex guides to the ODUs.

Antennas models depend on the frequency bands :

- **7 GHz** → 7.1 - 7.7 GHz
- **8 GHz** → 8.025 - 8.5 GHz
- **13 GHz** → 12.75 - 13.25 GHz

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- **15 GHz** → 14.4 - 15.35 GHz
- **18 GHz** → 17.7 - 19.7 GHz
- **23 GHz** → 21.2 - 23.6 GHz
- **26 GHz** → 24.5 - 26.5 GHz
- **38 GHz** → 37 - 39.5 GHz

Alternative antennas to those specified by Sagem may be used, but they must meet the following requirements

- Minimum gain to achieve adequate link margin,
- Radiation Pattern Envelope compliant to the network and country regulations
- Mechanical characteristics to meet specific site requirements (wind and frost resistance)

NOTE: *With some antennas, the manufacturer's guarantee applies only if the antenna feed is pressurized. Therefore, it is essential to observe the recommendations relative to the selected antenna type. Provision must therefore be made for:*

- *installation and connection of a pressurizing system if the antenna is connected to the ODU with a waveguide;*
- *use pressurization windows and seals to protect waveguide connections.*

1.4.1- Antenna Mount

In most cases, the antenna mounts provided by antenna manufacturers fit on tubular poles (diameter 88.9 to 114 mm).

If the antenna is installed on towers using another type of structure (e.g., square-section tower), special mounting kits must be used for this support.

The following precautions must always be taken :

- Allow enough clearance (± 10°) about the alignment axis. Leave also adequate space around the ODU to allow easy mounting.
- make sure that nothing may obstruct the link, even partially, especially in the near field of view,
- keep enough room for access to the antenna and ODU (for set-up and maintenance measurements),
- install proper lightning rod and earthing,

Note: *If there is an existing lightning rod, make sure that the ODU installation site is covered by the lightning protection cone*.

- misalignment under extreme weather conditions must not exceed ± 20 min angle in elevation and azimuth.

The antenna mount may be secured in different ways depending on the antenna installation site type and environment :

- mounting pole secured to the HEA section with a back-plate or clips,
- mounting pole secured to a square-shaped base plate with threaded rods. The base plate is set on top of a resilient plate which may be installed on the terrace of a building without affecting water-tightness,
- wall-mounted staff on the building front,

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- antenna mount secured directly to a tower tube (diameter 88.9 or 114 mm),
- antenna support secured to a square-section tower tube with adapters.

1.4.2 - Typical Antenna Installation

Refer to the antenna manufacturer procedures.

1.5 - Installing the ODU(s)

Depending on the configuration, and on the antenna type, there are several ODU mounting possibilities :

- **1+0 Configuration with integrated antenna : (or 1+1 configuration with two antennas)**
  The ODU is directly attached on an integrated antenna with four latches. It is connected to the IDU by a single coaxial cable terminated with N male connectors.

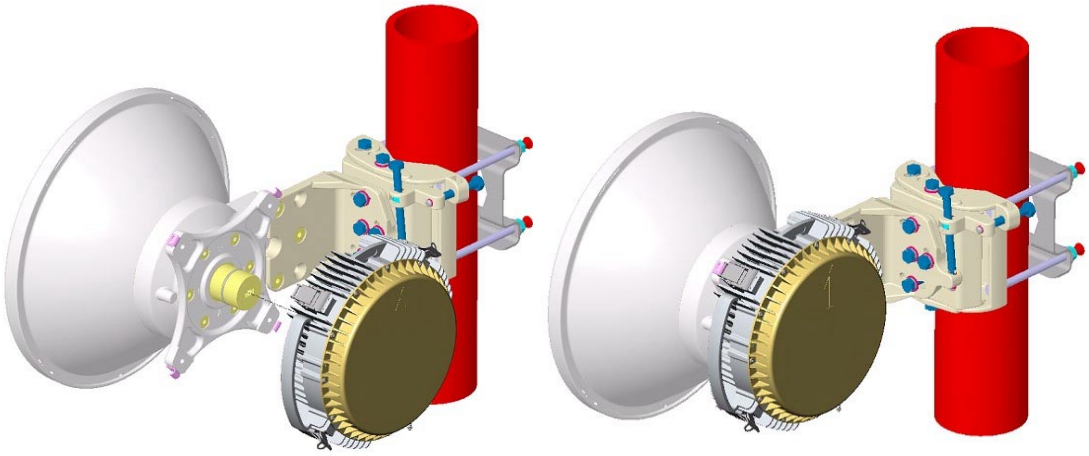

Figure 1.2 - SAGEM LINK F ODU with an Integrated Antenna

Setting the Polarization :
If antenna has a **circular waveguide interface** (7 GHz, 8 GHz or 38 GHz), polarization depends only on the ODU position. For vertical polarization, make sure that the arrow on the ODU cover is vertical, for horizontal polarization, turn the ODU from 90 degrees.

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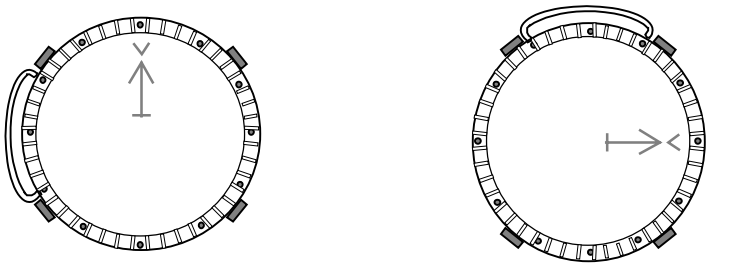

Figure 1.3 – Polarization Setting for the ODU

If antenna has a **rectangular waveguide interface** (13 GHz, 15 GHz, 18 GHz, 23 GHz and 26 GHz), then polarization depends on the antenna source position.
Note that ODU waveguide output must always be in the same position compared to antenna waveguide input.
For vertical polarization, turn antenna source in order to have the large side of the waveguide in horizontal position according to antenna manufacturer procedure. Install the ODU accordingly
For horizontal polarization turn antenna source to have the large side of the waveguide in vertical position. Turn also the ODU in order to have coincidence between ODU and antenna waveguides.

- **1+0 Configuration with remote mount and standard antenna :**
  In case of the use of a standard antenna (i.e. large antenna without SAGEM LINK F ODU interface), the ODU is mounted on a pole with a remote mount and connected to the antenna with a standard rectangular flex guide.

  Polarization depends on the antenna source position (vertical polarization is obtained when the big side of the antenna waveguide flange is horizontal).

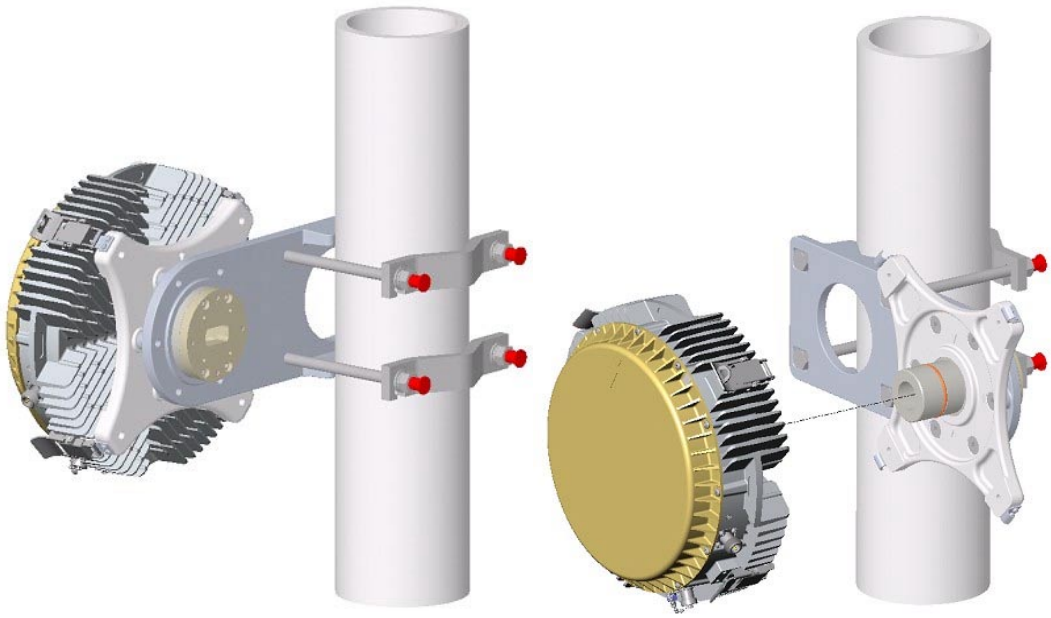

Figure 1.4 - SAGEM LINK F ODU Remote mount

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- **1+1 Configuration with a Coupler and an Integrated Antenna :**
  The coupler is attached on the integrated antenna with four bolts. Two ODUs are mounted vertically on the coupler with four latches. Each ODU is connected to its modem by a coaxial cable.
  As in most cases the coupler is not symmetrical, it is important to identify which ODU is connected to the main position, and which ODU is connected to protection position.

  Whatever the polarization is, 1+1 Coupler is always mounted in the same position

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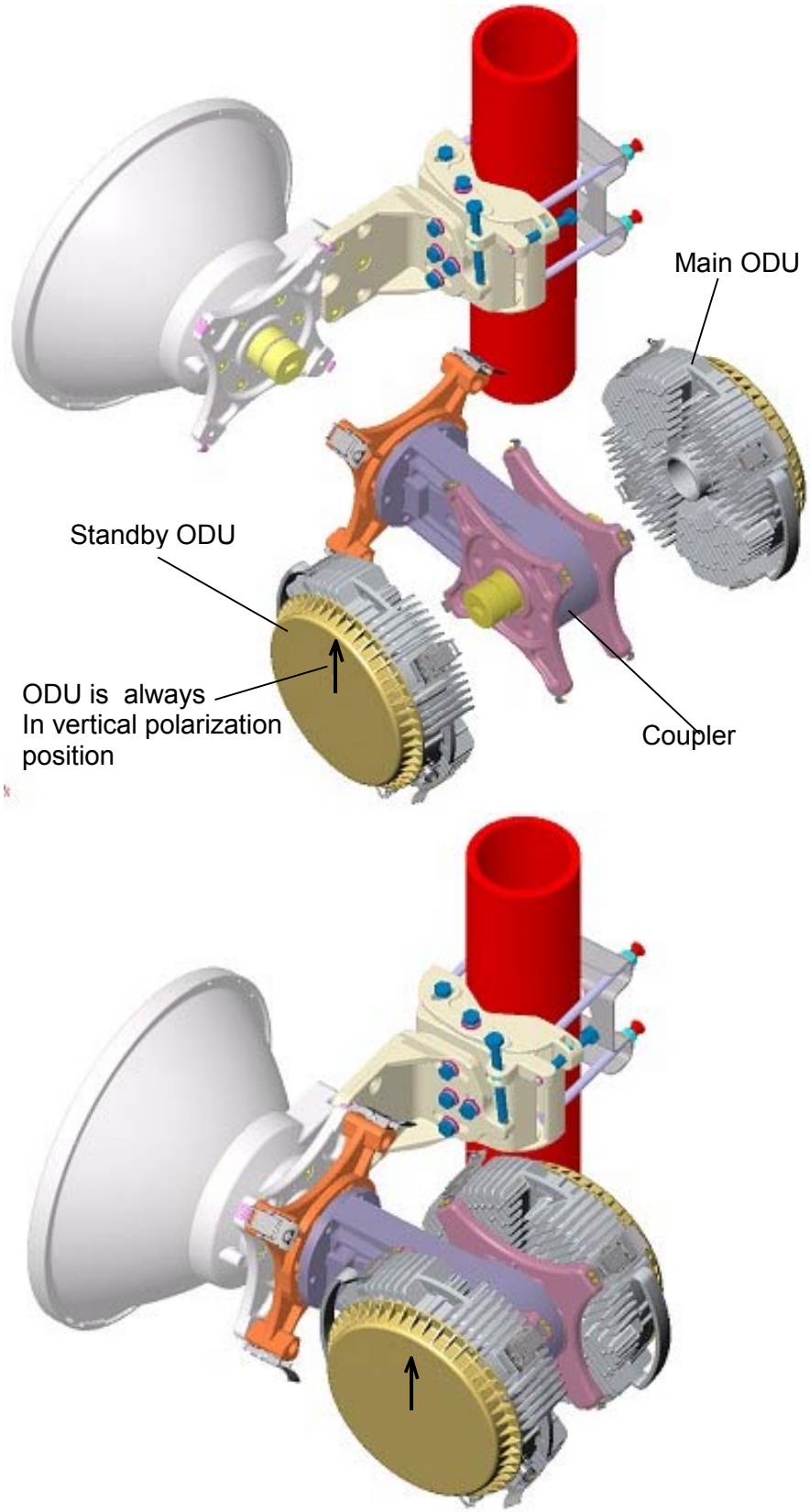

Figure 1.5 - SAGEM LINK F 1+1 Configuration with integrated antenna and coupler

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On the coupler there is a label indicating the position of main and stand by ODUs. By convention mount the coupler in order to have main ODU at the right and standby ODU at the left.

Polarization setting :

- Coupler : ODUs are mounted vertically on the coupler (arrow in vertical position). Polarization can be adjust by turning coupler polarizer from 90 degrees. To rotate polarizer, unscrew partially the two screws which block the polarizer. Vertical position is obtained when "V" marking appears on the polarizer. For Horizontal polarization, rotate polarizer to have "H" marking.

- Antenna : If the antenna has a rectangular waveguide interface, rotate antenna source to have the wanted polarization. Make sure that polarization are the same for antenna and coupler.

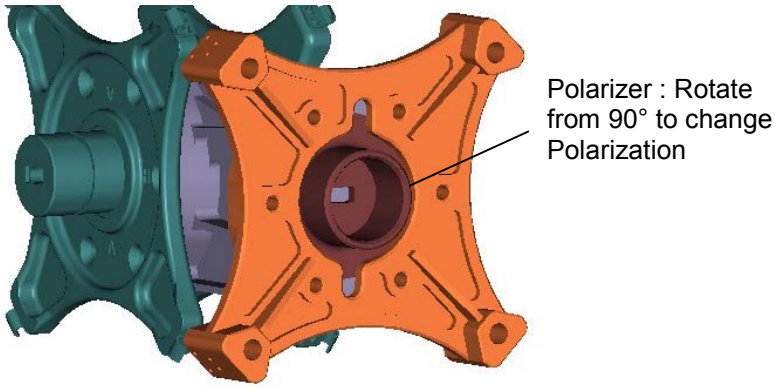

Figure 1.6 - SAGEM LINK F 1+1 Coupler

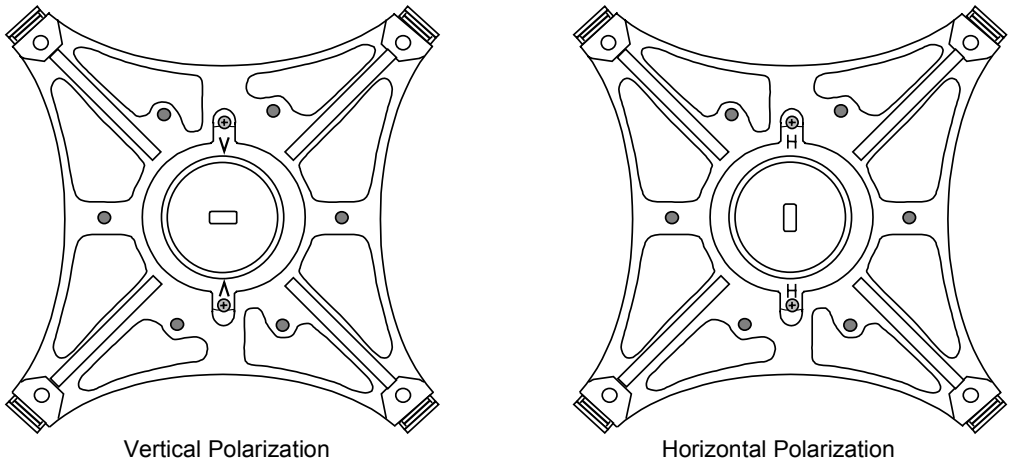

Figure 1.7 – Setting the Polarization for a 1+1 Coupler

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- **1+1 Configuration with a Coupler Remote Mounted and a Standard Antenna :**
  The coupler is attached on the remote mount and connected to the standard antenna by a flex guide.
  The two ODUs are vertically mounted on the coupler, with the arrows in vertical position. Each ODU is connected to the IDU with a coaxial cable.
  Polarisation setting is done by turning antenna source.

  As coupler is not symmetrical in most cases, it is important to identify main position (lowest insertion loss) and standby position.

  It is also necessary to identify ODU cables (main or standby) with a label.

- **1+1 Frequency Diversity Configuration with Remote Mounts and a Dual Polarized Antenna :**
  In this configuration each ODU is remote mounted on a pole, and is connected to an antenna access with a flex guide.
  It is important to identify ODU cables for the one which is on vertical polarization (main), and the one which is horizontal polarization (standby).

1.6 - Installing the IDU to ODU Coaxial Cable(s)

Recommended cables coaxial cables are Belden 9914 and Andrew LDF4-50A. If an other type of cable is used, make sure it is compatible with outdoor use. This cable should be double or triple shielded. Cable impedance is 50 Ohm, and is terminated by two N male connectors.

N connectors must be compatible with the cable, and connector mounting procedure must follow connector manufacturer recommendations.

Install one cable in a 1+0 system or two cables in a 1+1 system.

It is very important to protect N connectors against water : wrap Isolation tape (15 cm) over the coax cover. Start winding from coax cover with one half overlap with each winding in order to protect completely connection from rain action. Press with fingers the tape and make sure the protection is correct.

NOTE: *Cables must be installed in compliance with national and local regulations and meet the specific requirements of the installation site.*
Some precautions are necessary when installing the equipment on unprotected places (e.g., antenna towers, building terraces, etc.) to prevent equipment from damage by lightning.

In a 1+1 system when two cables are installed, it is very important to identify main cable and standby cable. If the cables are not labelled, it is necessary to perform a resistance check to identify each cable.
Disconnect N connectors from IDU, and short circuit one of the N connector on the ODU side (while the other one is open), and measure cable resistance on the IDU side. The lowest resistance corresponds to the short circuited cable.
Put labels on both sides of the cables.
Remove the short circuit, make sure connectors are clean and dry, and connect proper cable to each ODU.

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Cable Grounding

It is necessary to ground properly ODU to IDU cable for a good lightning protection. For this purpose, a cable grounding kit is provided as an option.

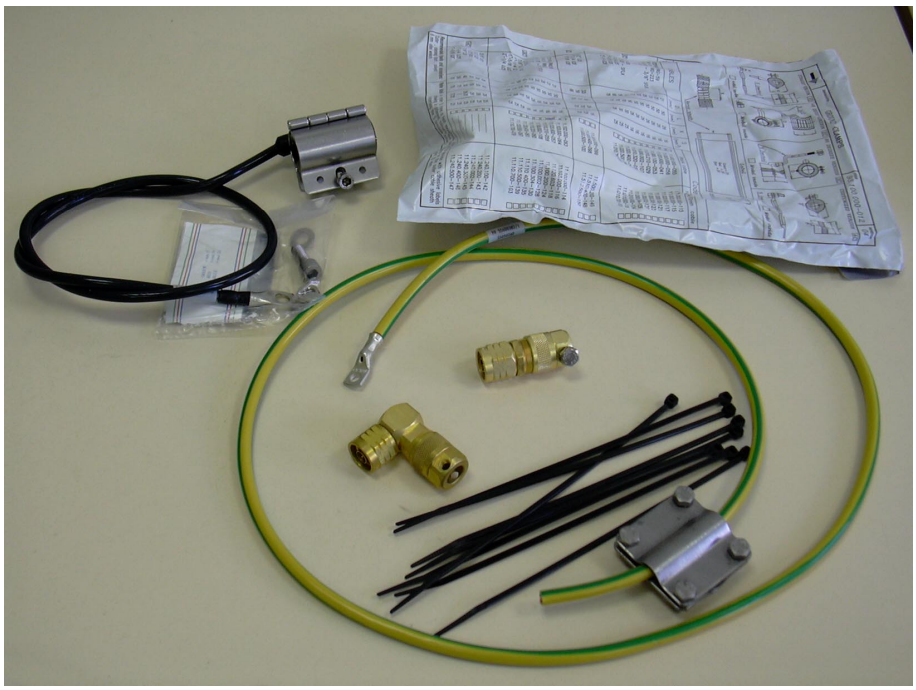

Figure 1.9 : SAGEM-LINK F Grounding Kit

The number of necessary grounding points depends on the site, and on the cable length. Normally, a good protection is achieved with :

- A grounding kit on the cable close to the ODU
- A grounding kit on the cable at the building entrance
- A grounding kit on the cable at the bottom of the pylon
- A grounding kit each 50 meters for long cables.

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1.7 - Powering Up the System

Before powering up the Sagem Link F terminal, check that :

IDU and ODU and cables are properly grounded

IDU and ODU are connected together with right coaxial cable(s). in 1+1 operation, main and standby cables have been previously identified and connected to the main and standby IDU cable interfaces

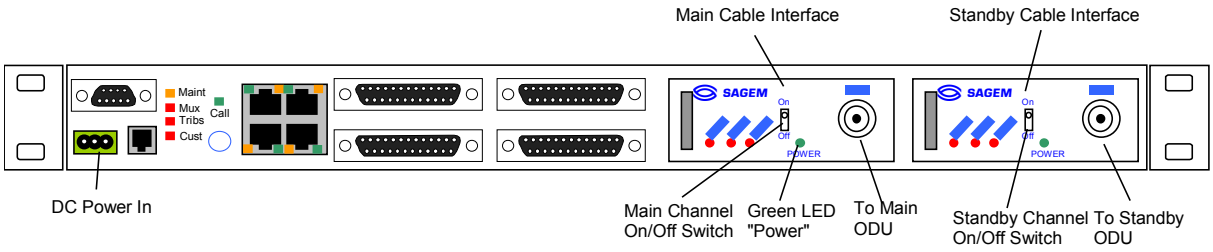

Figure 1.10 – SAGEM LINK F 1+1 IDU

Input DC Power Voltage is within specified range : - 36 VDC to –59 VDC (-48 VDC nominal). Measure DC voltage (polarity and amplitude) on the cable plug before connection into the IDU. Negative voltage must be used only. DC Connector Pinout is given in **Figure 1.11.**

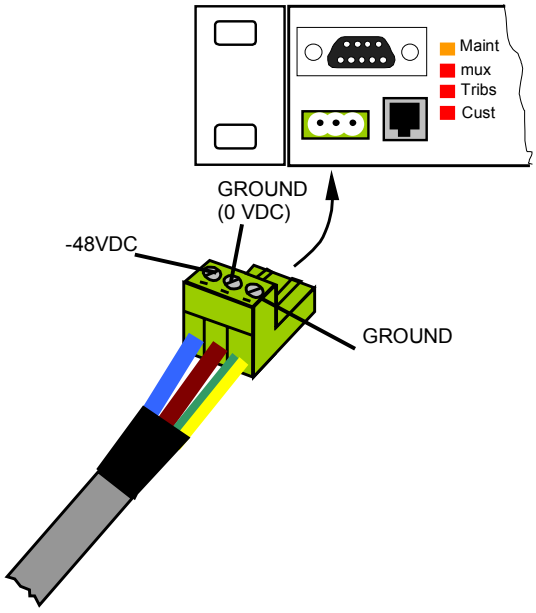

Figure 1.11 : IDU DC Input Connector

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Plug DC connector into IDU connector. If the terminal is a 1+0 system, switch on the terminal with the switch in front panel. If the terminal is a 1+1 system, switch on both switches.

The green LED(s) labelled "Power" should be lit.

Connect a PC on IDU front panel DB9 connector Labelled "PC" and run the Sagem Link F Pilot software

Verify and change if necessary, terminal local parameters (refer to Sagem Link Pilot description in chapter 4) :

- Transmit frequency,
- capacity,
- modulation,
- transmit power
- Link ID Code
- ATPC must be in the "Off" position at that time

Unless the link is already operating (remote parameters are displayed on the right side of the main screen of the Pilot software), make sure local terminal parameters are in accordance with far end terminal parameters. (Frequency, capacity, modulation, and Link ID Code must match)

If remote terminal parameters are good and if the main screen displays a "No Remote Radio" message, it means antennas are not properly aligned.

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1.8 - Aligning the Antennas

Antenna alignment is performed with both terminals operating, in normal weather conditions. The receive signal level (RSL) voltage is available on the ODU BNC connector.

A typical RSL curve at ODU access is given on Figure 1.10 The highest the RSL voltage is, the highest is the receive signal level.

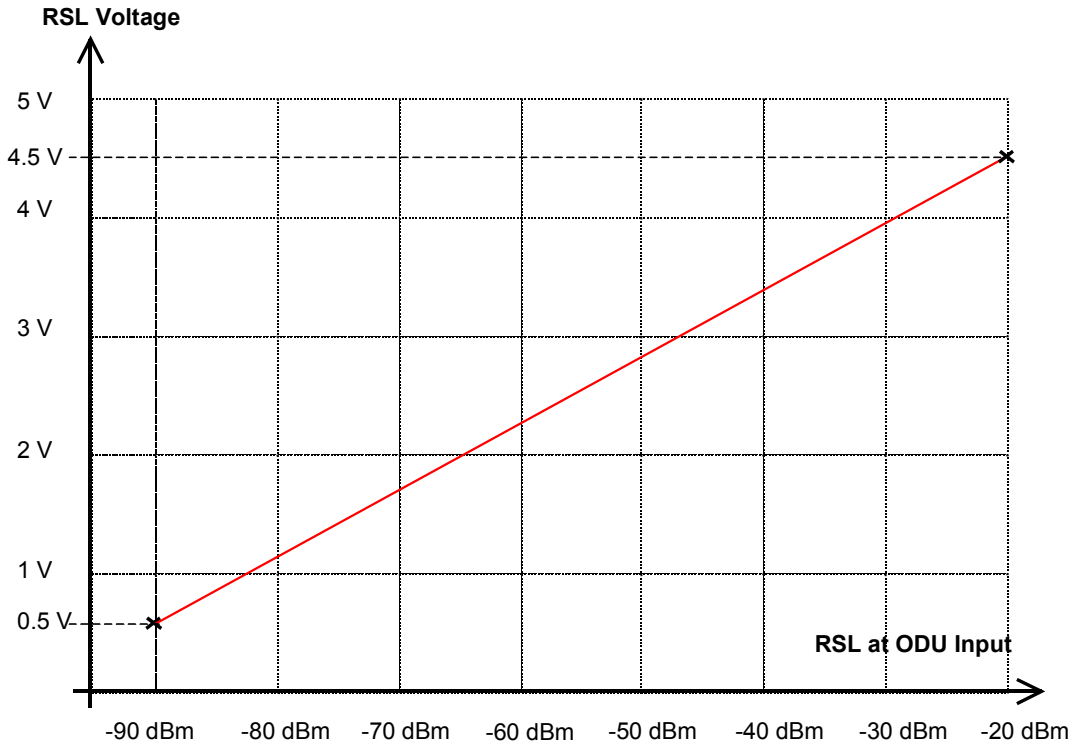
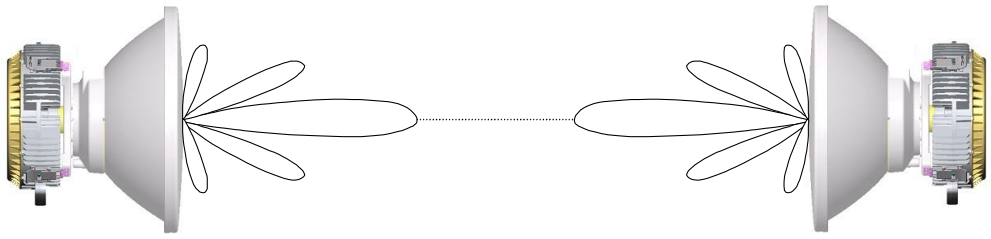


Figure 1.12 : Typical SAGEM LINK F Receive Signal Level Voltage

Note : RSL is measured at ODU antenna port. In some 1+1 systems involving a coupler or a remote mount antenna, it is necessary to take in account branching losses to know the actual power at antenna access.

Optimal performance is done when main antenna lobe is aligned with the center of the remote end antenna.
It is important to identify main lobe antenna, by rotating the antenna to have the maximum RSL voltage. Note there is around 25 dB difference between side lobes and main lobes (1.5 V).



Good Alignment

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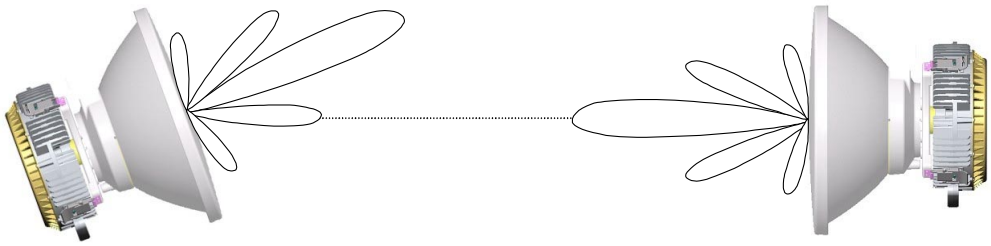

Bad Alignment

Figure 1.13 : Antenna Alignment

The expected receive signal level has previously being determined and depends on frequency, remote transmit power, local and remote antenna gains, and length hop.
Use the following procedure successively on both ends of the link to align the antenna :

1- Make sure remote transmit power is set in order to avoid overload at receive input (i.e. RSL less than –20 dBm).

2- Verify that remote terminal is operational

3- Remove the cap on the local ODU BNC connector and connect a voltmeter.

4- Rotate slowly the antenna in the azimuth direction (horizontal) and find the maximum voltage. If the voltage is around 4.5V (-20 dBm), then diminish the remote transmit power in order to be in a more linear region.

5- Rotate slowly the antenna in the elevation direction (vertical) until the voltage is maximum. Record the measured voltage.

6- When maximum voltage has been found, tighten all fasteners, verify that the voltage has not changed. Replace protective cap on the BNC connector.

7- Compare expected receive level with current receive level. If the difference between expected and actual receive is more than 4 dB, then it should be necessary to optimize again antenna alignment, or to check again if polarization is the same on both ends of the link.

Connect a laptop computer to the PC connector and run the Sagem Link F Pilot software. Normally, the link should be established (no "NO REMOTE RADIO" message displayed). The main screen should be like that :

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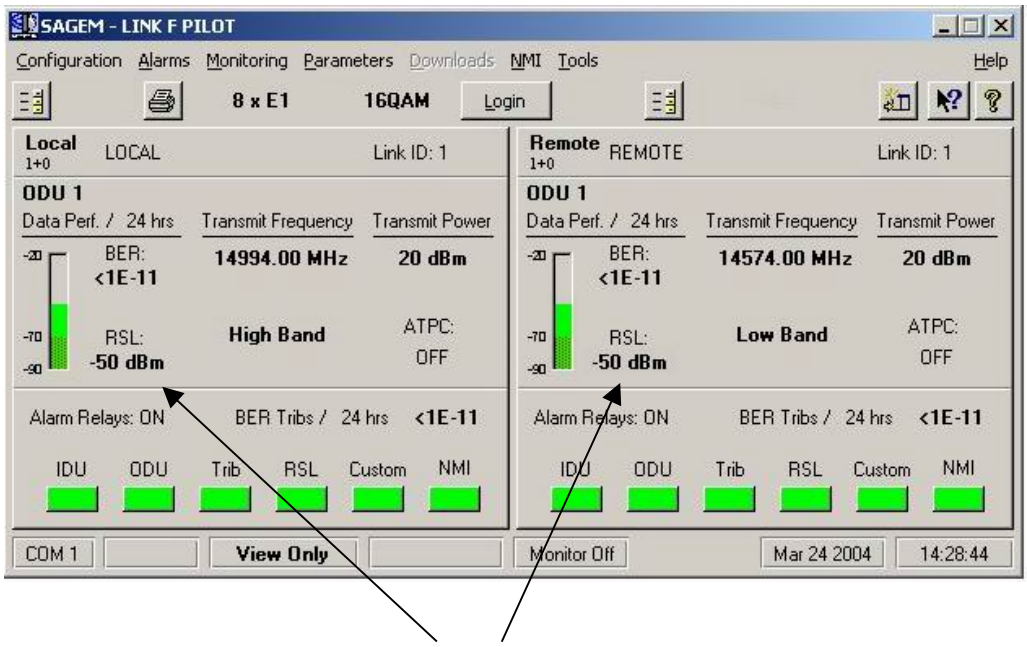

Receive Signal Levels should be similar on both ends
If there is more than 5 dB difference (with the same transmit output power), check antenna alignment, ODUs, IDUs, and antennas.

Figure 1.14 : Main Sagem Link F Pilot Screen

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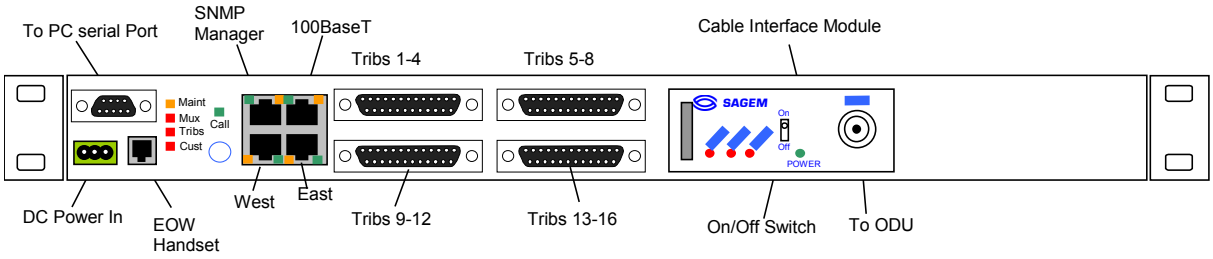
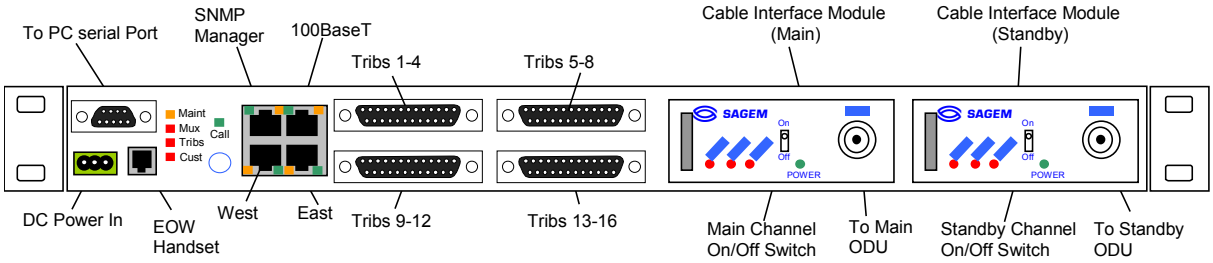
1.9 - Connecting IDU to External Equipments

1.9.1 - IDU Front Panel Access Description

The following access are available at the IDU Front panel (See Figure 1.15) :



IDU for 1+0 System



IDU for 1+1 System

Figure 1.15 – SAGEM LINK F IDU Front Panel for 1+0 and 1+1 Systems

- a power connection from a negatively biased DC source of between –36 VDC and -59 VDC, labeled "**Power**",
- a point-to-point Engineering Order Wire RJ11 connection labeled "**EOW**",
- a **PC** port to connect a local craft terminal, via a DB 9 connector,
- Four Ethernet ports (RJ 45 connectors):
  - 3 x 10 baseT Ports dedicated to Network Management Interface **"Mgr"**, **"West"**, **"East"** (Ethernet hub),
  - 1 x 100 baseT Port **"100bT"** (option)
- 16 x G703 2 Mbit/s tributary ports (4 tributaries per DB25 connector) in unbalanced 75 Ω mode, or in balanced 120 Ω mode, the selection between modes is controlled by software : **"Tribs 1-4"**, **"Tribs 5-8"**, **"Tribs 9-12"**, **"Tribs 13-16"**.
- One N connector per ODU connection "**ODU".**
- One ground connection ("Faston" connector).

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1.9.2 - IDU Rear Panel Access Description

The following access are available at the IDU Rear panel (See Figure 1.16)

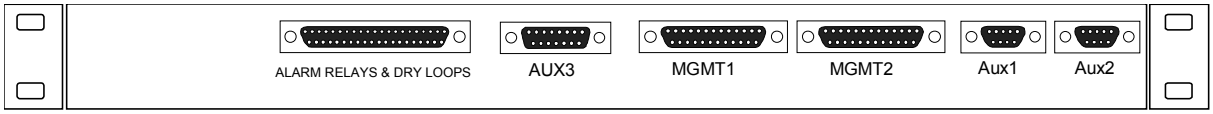

Figure 1.16 – SAGEM LINK F IDU Rear Panel

The IDU rear panel provides the following interfaces (Figure rrr):

- a DB37 connector labeled "**ALARM RELAYS & DRY LOOPS"** including terminal alarm relays, and 4 input output dry loops.
- a DB15 connector labeled "**AUX3**" corresponding to a 64 kbit/s auxiliary data channel with a V11 electrical interface, that can be configured in either co-directional or contra-directional mode,
- two "**MGMT1"** and "**MGMT2"** DB25 connectors: management ports, MGMT1 configurable in synchronous V11 or asynchronous V28 mode and MGMT2 used in synchronous V11 mode
- two 9600 bit/s (max.) asynchronous digital auxiliary data channels **"AUX1"** and **"AUX2"** (DB9 connectors), with V11 or V28 electrical interface configurable by software.

1.9.3 - Connectors Pinout Description

Local Craft Terminal Connection

Local Craft Terminal connection is made via a serial access (DB9 connector). Connector Pinout is given in Figure 1.17.
This is a DCE, V28 interface, compliant to EIA 574 standard.

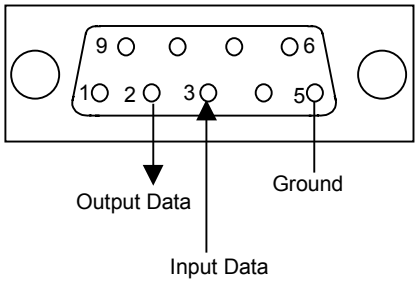

Figure 1.17 - DB9 PC connector Pinout

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Engineering Order Wire

The IDU female connector "EOW " (RJ11) provides connection to a telephone handset.

Pin	Description
1	Microphone (input)
2	Earpiece (ground)
3	Earpiece (output)
4	Microphone (ground)

Figure 1.18 - Engineering Orderwire Connector Pinout

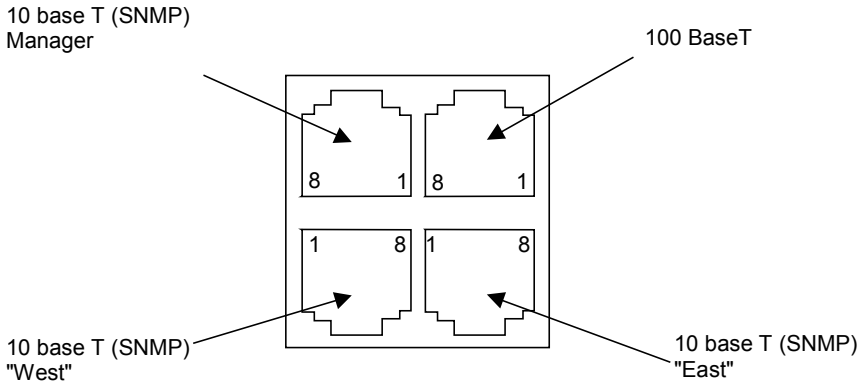
Note : Handset is provided as an option

Ethernet Ports

Four RJ45 Ethernet Ports are available : three of them are use for Network Management operation, the fourth is dedicated to an optional 100 baseT transmission.

The ports "Mgr", "East" and "West" are part of an internal 10 baseT Ethernet hub, and can be connected to other IDUs or to a SNMP manager.

The pinout of Ethernet Ports are given in Figure 1.19



PIN No	Signal name	Description
1	TX_ETH_P	Ethernet output (+)(output)
2	TX_ETH_N	Ethernet output (-)(output)
3	RX_ETH_P	Ethernet input (-)(input)
4	-	NC
5	-	NC
6	RX_ETH_N	Ethernet input (-)(input)
7	-	NC
8	-	NC

Figure 1.19 – Ethernet Ports Pinout

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E1 Tributaries Connections

The four DB25 connectors in IDU front panel correspond to four x 4 Input/output 2 Mbit/s access (E1).

These access are available in 120 Ω balanced mode, or in 75 Ω unbalanced mode. Impedance mode is controlled by the Pilot software.
It is possible to have one connector configured in balanced mode, while the others are configured in unbalanced mode.
It is not possible to have on the same DB25 connector two tributaries in a different mode.

Tributary connector pinout corresponding to tributaries 1 to 4 is given in Figure 1.20. The other tributary connectors have the same pinout.

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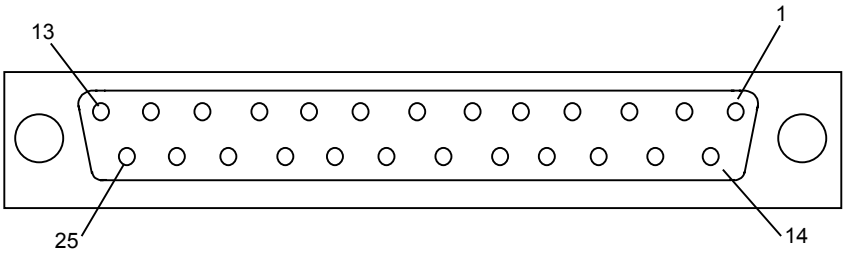

Pin	Signal	120 Ohm balanced	75 Ohm unbalanced
1	GND	Ground	Ground
14	TXHDB3P1	Transmit trib #1 - P	Transmit trib #1
2	GND	Ground	Ground
15	TXHDB3N1	Transmit trib #1 - N	*Grounded by the cable*
3	RXHDB3P1	Receive trib #1 - P	Receive trib #1
16	GND	Ground	Ground
4	RXHDB3N1	Receive trib #1 - N	*Grounded by the cable*
17	TXHDB3P2	Transmit trib #2 - P	Transmit trib #2
5	GND	Ground	Ground
18	TXHDB3N2	Transmit trib #2 - N	*Grounded by the cable*
6	RXHDB3P2	Receive trib #2 - P	Receive trib #2
19	GND	Ground	Ground
7	RXHDB3N2	Receive trib #2 - N	*Grounded by the cable*
20	TXHDB3P3	Transmit trib #3 - P	Transmit trib #3
8	GND	Ground	Ground
21	TXHDB3N3	Transmit trib #3 - N	*Grounded by the cable*
9	RXHDB3P3	Receive trib #3 - P	Receive trib #3
22	GND	Ground	Ground
10	RXHDB3N3	Receive trib #3 - N	*Grounded by the cable*
23	TXHDB3P4	Transmit trib #4 - P	Transmit trib #4
11	GND	Ground	Ground
24	TXHDB3N4	Transmit trib #4 - N	*Grounded by the cable*
12	RXHDB3P4	Receive trib #4 - P	Receive trib #4
25	GND	Ground	Ground
13	RXHDB3N4	Receive trib #4 - N	*Grounded by the cable*

Figure 1.20 – DB25 Tributary Connector Pinout

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Alarm Relays and I/O Dry Loops

The rear panel DB37 connector includes

- **5 alarm relays** : these alarms are managed by SAGEM LINK Pilot software. The electrical interfaces for each alarm is given in Figure 1.21 :

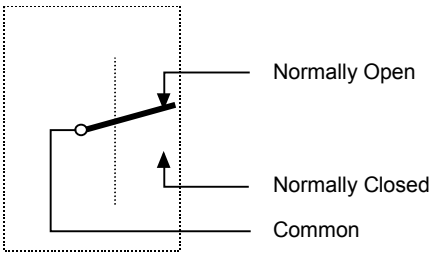

Figure 1.21 – Alarm relay electrical interface

The alarm condition correspond to normally closed state of the relay.
NC= Normally Closed
NO= Normally Open

- 4 Inputs / Outputs dry loops: the electrical interface for each loop is given in Figure 1.20 :

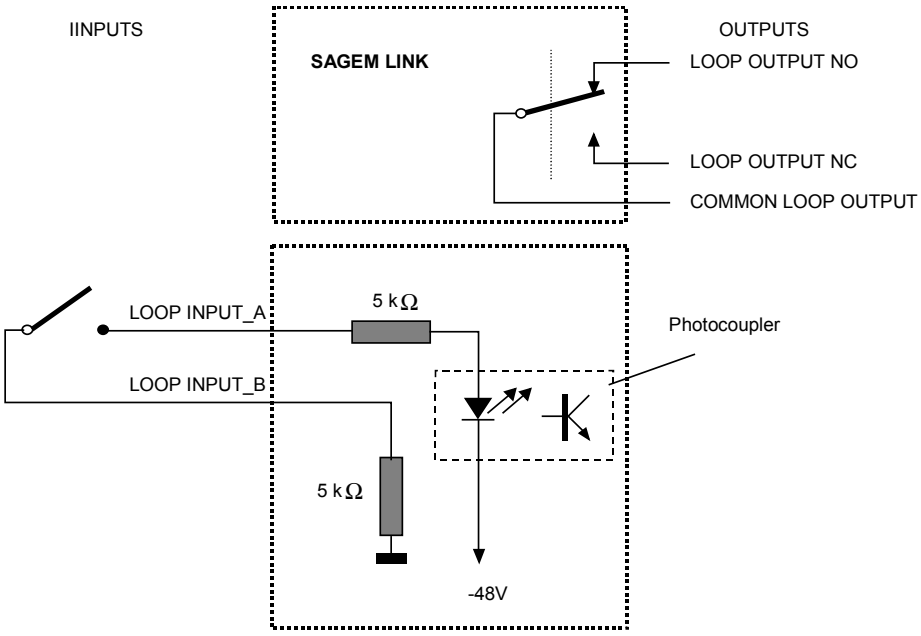

Figure 1.22 – I/O Dry Loop electrical interface

The pinout of DB37 connector is given in Figure 1.23

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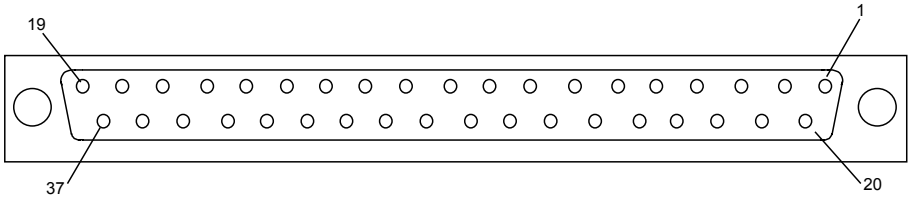

PIN #	I/O	Signal
1	-	GROUND
20	I	LOOP INPUT #1 – A
2	I	LOOP INPUT #1 – B
21	I	LOOP INPUT #2 – A
3	I	LOOP INPUT #2 – B
22	I	LOOP INPUT #3 – A
4	I	LOOP INPUT #3 – B
23	I	LOOP INPUT #4 – A
5	I	LOOP INPUT #4 – B
24	O	LOOP OUTPUT #1 NC
6	O	COMMON LOOP OUTPUT #1
25	O	LOOP OUTPUT #1 NO
7	O	LOOP OUTPUT #2 NC
26	O	COMMON LOOP OUTPUT #2
8	O	LOOP OUTPUT #2 NO
27	O	LOOP OUTPUT #3 NC
9	O	COMMON LOOP OUTPUT #3
28	O	LOOP OUTPUT #3 NO
10	O	LOOP OUTPUT #4 NC
29	O	COMMON LOOP OUTPUT #4
11	O	LOOP OUTPUT #4 NO
30	O	ALARM RELAY #1 NC
12	O	COMMON ALARM RELAY #1
31	O	ALARM RELAY #1 NO
13	O	ALARM RELAY #2 NC
32	O	COMMON ALARM RELAY #2
14	O	ALARM RELAY #2 NO
33	O	ALARM RELAY #3 NC
15	O	COMMON ALARM RELAY #3
34	O	ALARM RELAY #3 NO
16	O	ALARM RELAY #4 NC
35	O	COMMON ALARM RELAY #4
17	O	ALARM RELAY #4 NO
36	O	ALARM RELAY #5 NC
18	O	COMMON ALARM RELAY #5
37	O	ALARM RELAY #5 NO
19	-	GROUND

Figure 1.23 – Alarm relays and I/O Dry Loop Connector Pinout

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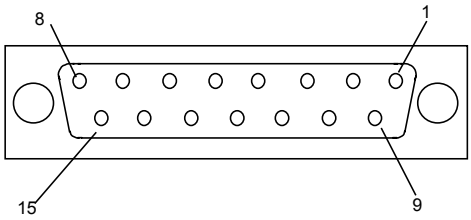
64 kbit/s Auxiliary Data Channel (AUX3)

The 64 kbit/s auxiliary data channel connector "AUX3" is available in a DB 15 connector on the rear panel.
This data channel can be configured in a **V11 co-directional mode** (transmit clock given by the external equipment) or in a **V11 contra-directional mode** (transmit clock given by SAGEM LINK F) :
Aux3 Connector pinout is given in Figure 1.24



Pin #	I/O	Signal
1	I	Byte Timing Input (-)
9	I	Transmit Data Input (-)
2	I	Byte Timing Input (+)
10	I/O	Transmit Clock (-)
3	O	Byte Timing Output (-)
11	I/O	Transmit Clock (+)
4	O	Receive Data (+)
12	O	Receive Clock (+)
5	O	Receive Data (-)
13	O	Receive Clock (-)
6	O	Byte Timing Output (+)
14	-	Ground
7	-	Ground
15	-	NC
8	I	Transmit Data Input (+)

Figure 1.24 – Aux3 Data Channel Connector Pinout

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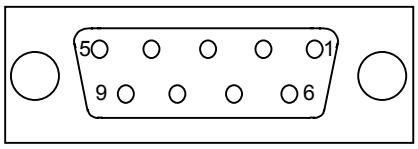
9600 bit/s Auxiliary Data Channel (AUX1 & Aux2)

The 9600 bit/s auxiliary data channels "AUX1" and AUX2 are connected to two DB 9 connectors on the rear panel.
This data channels can be configured either in a DCE **V11 interface, or V28 interface** (compliant to EIA 574 standard). Depending on the interface, connector pinout is given on Figure 1.25



Pin #	V11 Interface	V28 Interface
1	Ground	Ground
6	NC	NC
2	Output Data – (+)	Output Data
7	Output Data – (-)	NC
3	Input Data – (+)	Input Data
8	Input Data – (-)	NC
4	NC	NC
9	NC	NC
5	Ground	Ground

Figure 1.25 – Aux1 or Aux2 Data Channel Connector Pinout

Serial Management Interface Ports MGMT1 and MGMT2

Serial management interface ports MGMT1 and MGMT2 are available in two DB25 connectors located on the rear panel.

MGMT1 port can be configured in two modes :
- V11 synchronous mode (EIA 530)
- V28 asynchronous mode (ISO 2110)

MGMT2 port is not configurable, and is only available in V11 synchronous mode.

Connector pinout is given in Figure 1.26

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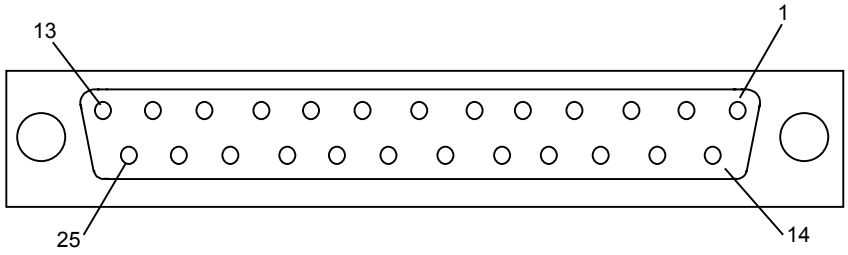

Pin #	V11 Mode	V28 Mode (MGMT1 only)
1	Ground	Ground
14	Transmit Data – (-)	NC
2	Transmit Data – (+)	Transmit Data
15	Transmit Clock – (-)	NC
3	Receive Data – (+)	Receive Data
16	Receive Data – (-)	NC
4	NC	Request to Send
17	Receive Clock (+)	NC
5	NC	Clear to Send
18	NC	NC
6	NC	DCE Ready
19	NC	NC
7	Ground	Ground
20	NC	DTE Ready
8	NC	NC
21	NC	NC
9	Receive Clock (-)	NC
22	NC	NC
10	NC	NC
23	NC	NC
11	NC	NC
24	NC	NC
12	Transmit Clock (-)	NC
25	NC	NC
13	NC	NC

Figure 1.26 – MGMT1 and MGMT2 Management Ports Connector Pinout

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Cable References for SAGEM LINK F

The cables which can be connected to the IDU front panel are shown in Figure 1.27.

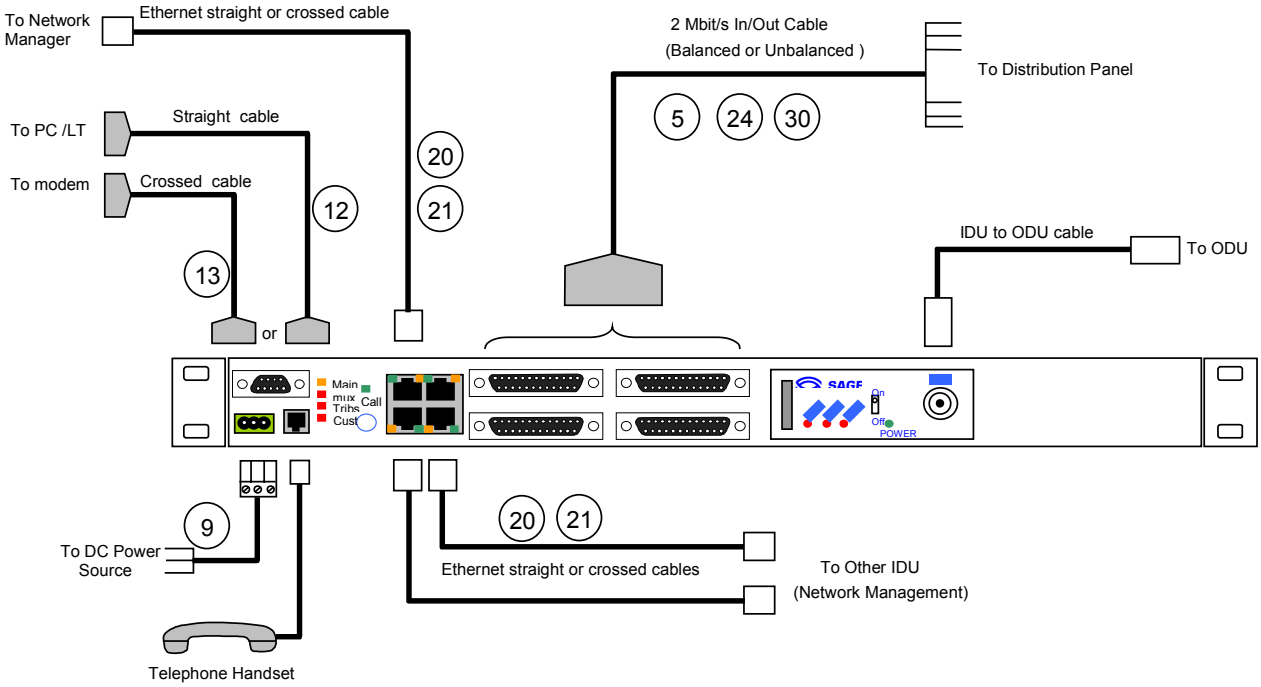

Figure 1.27 – Cables for a Terminal Station – Front Panel

The cables which can be connected to the IDU rear panel are shown in Figure 1.28.

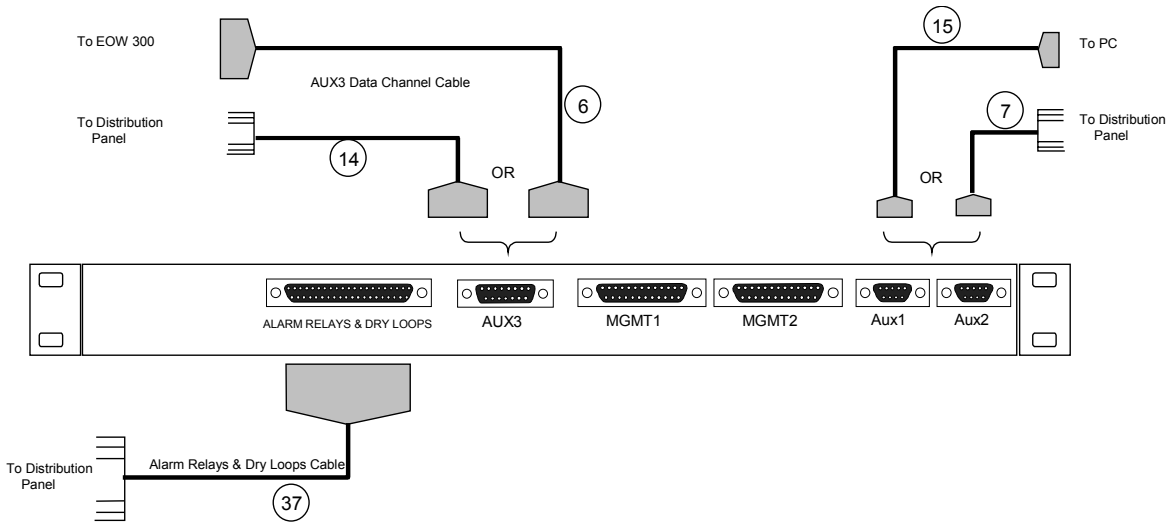

Figure 1.28 – Cables for a Terminal Station – Rear Panel

In a relay station IDU are connected "back to back". Typical connection is given on Figures 1.29 and 1.30

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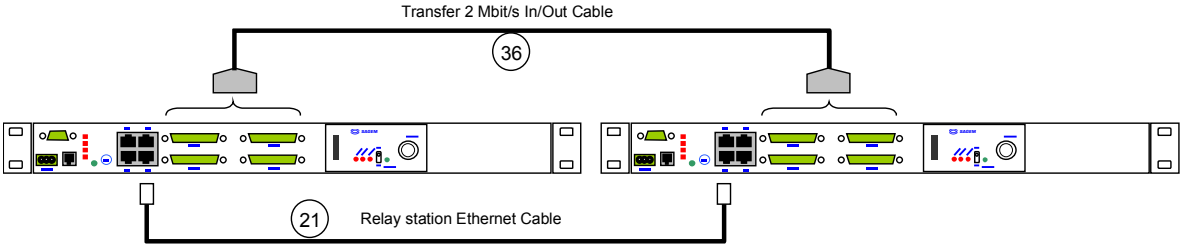

Figure 1.29 – Cables for a relay station – Front Panel

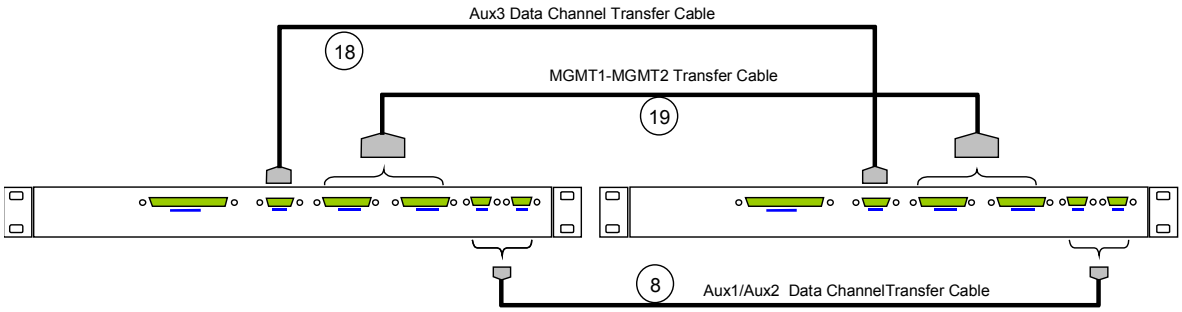

Figure 1.30 – Cables for a relay station – Rear Panel

Table 1.1 indicates Sagem Part Number for all cables for this IDU (terminal or relay modes).

Figure item	Drawing #	Designation	Lenght	SAGEM P/N
9	55050152EA	- DC Power cable	2.5 m 5 m 12 m 25 m	55670225 55670226 55670227 55670228
5	55050138EA	- 2 Mbit/s tributary 120 Ω In/Out cable	2.5 m 5 m 12 m 24.8 m	55670182 55670183 55670184 55670185
30	55670563EA	- 2 Mbit/s tributary 75 Ω In/Out cable DB25 – 8 BNC-F	2.5 m 5 m 12 m 25 m 60 m	55670563-2M5 55670563-5M0 55670563-12M 55670563-25M 251043775
24	55670405EA	- 2 Mbit/s tributary 75 Ω In/Out cable DB25 – 8 BNC-M	2.5 m 5 m 12 m 25 m	55670405-2M5 55670405-5M0 55670405-12M 55670405-25M
12	55050156EA	- PC/LT connection cable	1.5 m 3 m	55670223 55670224
13	55050184EA	- Modem connection cable	1.5 m 3 m	55670340 55670341
14	55050185EA	- Aux3 data channel cable to dist. Panel	2.5 m 5 m 12 m 25 m	55670342 55670343 55670344 55670345
6	55050149EA	- Aux3 - EOW 300 channel cable	1.5 m 3 m	55670221 55670222

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Figure item	Drawing #	Designation	Lenght	SAGEM P/N
18	55050189EA	- AUX3 data channel transfer cable	1.5 m 3 m	55670352 55670353
36		- Crossed 2 Mbit/s tributary transfer cable	2.5 m	251027429
7	55050150EA	- Aux1/Aux2 - Data channel cable to distribution panel	2.5 m 5 m 12 m 25 m	55670215 55670216 55670217 55670218
15	55670420EA	- Aux1/Aux2 - PC connection cable	1.5 m 3 m	55670420-1M5 55670420-3M0
8	55050151EA	- AUX1/AUX2 data channel transfer cable	1.5 m 3 m	55670219 55670220
37	251389233EA	- Alarm relays and dry loops cable to Distribution panel (DB37)	2.5 m 5 m 12 m 24.8 m	251378024 251378037 251378045 251378058
20		- Straight ETHERNET cable (NMI/NMI transfer or to manager)	1.5 m 3 m	55670421 55670422
21		- Crossed ETHERNET cable (NMI/NMI transfer or to manager)	1.5 m 3 m	55670423 55670424
19	55050190EA	- MGMT1 - MGMT2 transfer cable	1.5 m 3 m	55670354 55670355

Table 1.1 – Cables Part Numbers

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Chapter 2

Commissioning

2.1 - Overview

This chapter explains how to verify Sagem Link F correct operation after installation. Testing procedures are given in order to check radio system is operating according to the specifications.

The tests performed are :

- Frequency Scan
- Receive Signal Level
- Tributary Tests
- Engineering Order Wire (optional)
- Alarm Relays and I/O Dry Loops Test (optional)
- 1+1 Verification (optional)
- BER measurement

Required test equipment

- Laptop Computer with a serial interface
- Sagem Link F Pilot software
- 2 Mbit/s Bit Error Rate Analyzer
- Digital voltmeter

Sagem Link F Field Commissioning Form

A field commissioning form is provided in order to record all measurement data and remarks during commissioning operation.

2.2 - Preliminary Verifications

Before beginning commissioning tests, it is necessary to check the following :

- Verify all equipment for damage occurred during installation
- Verify that all equipments are properly mounted
- Verify antenna polarization
- Check ODU, cable and IDU groundings
- Measure DC Input Voltage on each terminal and record it on the commissioning form
- Connect laptop computer to the PC DB9 connector on the IDU front panel, and run the Sagem Link F Pilot software. Be sure to be logged in super user mode (Default password = 2345). On the main screen verify and change if necessary :
  - Local and Remote terminal transmit frequency
  - Modulation type and Capacity
  - Local and Remote terminal nominal transmit power, ATPC should be in “OFF” position
  - Tributary Impedance
  - Link ID Code
  - If there is a tributary alarm, verify tributary inputs configuration and connections.
  - If there are other alarms, or if the link does not work, refer to the troubleshooting section in this manual

Note any discrepancy in the field commissioning form.

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2.3 - Frequency Scan

A special function of the Pilot software is to measure and to record automatically the receive spectrum around receive frequency. This operation is done on the local terminal only. During frequency scan process, local transmitter is in mute position, so the link is not operating.

This measurement allows the user to measure interferer levels around receive frequency and to display it graphically. A record of this measurement is stored in the flash memory, and can be consulted after installation. In order to check interferer level at receive frequency, it could be necessary to mute the remote transmitter.

Refer to frequency scan procedure in chapter 3 section 3.3.7.6.

Frequency scan is to be done separately on each end of the link.

Note in the commissioning form the presence of interferers close to the receive signal (adjacent and second adjacent)

2.4 - Receive Signal Level

In normal weather conditions, the receive signal level depends on :

- Remote Transmit Power (tolerance : ± 2 dB)
- Remote and Local antenna gains (tolerance : ± 1 dB each)
- Free Space Path Attenuation
- Coupler Losses for a 1+1 Hot Stand By system, or flex guide losses for a remote mount system

Compare the actual receive signal level displayed on the main screen of the Pilot software, with the expected signal level.

As the tolerances are:

- ± 2 dB for the transmit power
- ± 1 dB for the antenna gain (per antenna)
- ± 3 dB for the receive level measurement
- ± 0.5 dB for 1+1 coupler losses

If we want to compare the receive level displayed with the expected calculated receive level, it is necessary to take in account the tolerances for each parameter :
For a 1+0 system, the worst case for this comparison is within ±7 dB (±2 ±1 ±1 ± 3). For most of the cases, a typical tolerance is **±5 dB**.

So, if the receive level displayed by the Pilot software is less than 5 dB compared to the calculated receive level, it should be necessary to check again antenna alignment, a propagation problem or a wrong polarization first. If there is still a problem on the receive level, replace ODU, then IDU, and if necessary the antenna.

Record the measured receive signal level at each end of the link for each receiver.

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2.5 - Tributary Tests

These tests are to be done on both ends of the link.

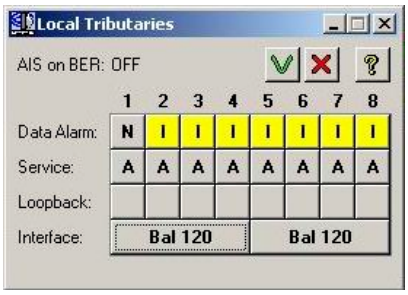
Using a BER analyzer with G821 capability, test all used 2 Mbit/s access.

BER Analyzer Settings :

- Transmit to Receive test
- 2 Mbit/s
- Internal Clock
- PRBS : 2^{15}-1.
- 120 Ohm balanced, or 75 Ohm unbalanced depending on IDU configuration.

All used tributaries are to be tested one by one :

- Click on the button (top left of the toolbar on main screen) or use the menu : "Tools / Tributaries". The tributary screen appears.
- Verify that the tributary under test is configured in normal mode (N), with active service (A), and no loopback (blank button).
- All other tributaries should be unconnected and configured as inverted (I)



- Normally there should be a local tributary alarm.
- Connect a 2 Mbit/s BER analyzer on the tributary input. Be sure to use a cable in the same impedance (refer to "Interface" indication). The tributary alarm should be now cleared.
- Click on the loopback button to have access to loopback configuration screen, and select a remote loopback for the tributary under test. (For loopback procedure refer to Chapter 3, section 3.2.4).
- Verify on the BER analyzer that there is no error occurred during one minute
- Once the test has been done, disconnect the cable, and change Data alarm in invert mode (I), and remove remote loopback for this tributary.
- Repeat this test for all used tributaries.

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2.6 - Engineering Order Wire Test (optional)

If the handsets have been ordered, the following test is made to verify EOW proper operation. This test requires the presence of people in local and in remote station. Connect handset in each IDU of the link (RJ11 connector)

- From the local terminal press on the call button (PRESS). At the remote end the green led corresponding to the EOW flashes. Verify that audio communication is operating properly

- Make the same test from the remote terminal.

2.7 - Alarm Relays and I/O Dry Loops Test (optional)

When alarm relays and I/O dry loops are used in the site, perform the following tests to verify proper alarm operation.
This test is to be done on each end of the link.
Before starting the test verify that there is no alarm displayed in the equipment.

It is not possible to simulate all possible alarms without opening equipment : for instance, simulating a Tx frequency alarm would require to open the ODU and to disturb externally the synthesizer phase lock loop. However some alarms can be simulated with simple operations :

2.7.1 - Simulating an IDU Alarm

An IDU alarm could be easily simulated by entering a wrong Link ID code in the local terminal. This wrong ID Code generates an IDU alarm, but does not affect modem or radio operation. To simulate an IDU alarm :

- Remove DC Power on the local terminal, and disconnect IDU to ODU cable
- Power up the IDU, and change local ID Code.
- Switch off again DC power and connect IDU to ODU cable
- Switch on the IDU. Once the IDU is properly initialized, there should be an IDU alarm displayed.
-

Once the test has been done, do not forget to write the right Link ID code using the same procedure.

2.7.2 - Simulating an ODU Alarm

An ODU alarm can be obtained by removing IDU to ODU cable. Prior to removing ODU cable, it is necessary to switch off the cable interface module.

2.7.3 - Simulating a Tributary Alarm

A tributary alarm is obtained by changing the status of one tributary from normal (N) to invert (I), or from invert to normal.
Once the test has been done, do not forget to restore the previous configuration.

2.7.4 - Simulating a RSL Alarm

To simulate a RSL Alarm, it should be necessary to diminish remote transmit power and to increase RSL alarm threshold. (ATPC off).
Change the RSL alarm threshold to -60 dBm.

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Decrease slowly remote transmit power in order to have a receive level below –60 dBm. Take care to avoid to break the link, because in this case, it will not be possible to establish again communication from the local terminal.
Once the test has been done, do not forget to restore previous settings.

2.7.5 - Simulating a Custom Alarm

To simulate a Custom alarm, configure " Local Aux1 Alarm" on the "Custom relay" (use the menu **Alarms / Config / Local**, and select the **IDU** tab).
Then short circuit pins 2 and 20 of the DB37 connector (LOOP INPUT #1 – A and LOOP INPUT #1 – B).
The alarm is displayed in the screen **Alarm/View/Local** - **ALL** tab. Verify that the alarm is cleared when the loop is in open position.

2.7.6 - Testing Input Dry Loops

Affect " Local Aux1 Alarm", " Local Aux2 Alarm", " Local Aux3 Alarm" and " Local Aux4 Alarm" on the Custom relay, and verify the alarm changes by short-circuiting or opening the loops.

2.7.7 - Testing Alarm Relays

For this test, it is necessary to use a multimeter to check continuity between contacts.

The three contacts of each relay are available in the DB 37 connector (see Figure 2.1) :

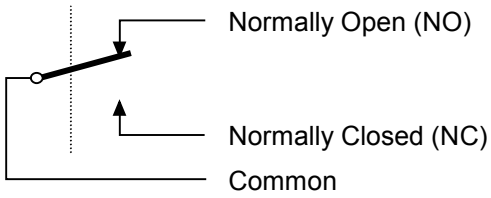

Figure 2.1 : Relay Contacts

When the IDU is not powered, the NC is connected to the Common, while the NO is in open position.

When the IDU is powered and when there is no alarm :

- NO is connected to Common
- NC is not connected to Common

When there is an alarm on the relay under test (use the above procedure to simulate alarms) :

- NC is connected to Common
- NO is not connected to Common

Simulate various alarms, and test the corresponding relays upon this procedure.

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2.8 - 1+1 Verification (optional)

1+1 systems require additional tests compared to unprotected systems. These tests are made to verify main and stand by units, and switches proper operation.

These tests are made on both sides of the link. As a remote switch control is not available for security reasons, this test may require the presence of people on both sides of the link.

In hot standby mode, only one transmitter is active at a time. For a 1+1 system in frequency diversity mode, both transmitter are active, and only receiver switchings are to be made.

In normal operation with revertive switching on, and without any alarms, the active transmitters and receivers are the main units.

Du to the use of an asymmetrical coupler, the transmit power at antenna access and the receive signal level at ODU access depend on the switches positions. For a 6 dB coupler, the difference between the main and standby unit is around 5 dB.
In the figures below, active transmitter and receiver are written in bold characters.

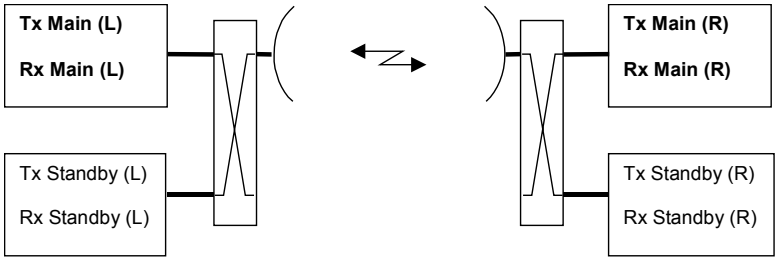

Figure 2.2 : Main local transmitter and receiver active

From the local terminal, connect a BER analyzer on a 2 Mbit/s tributary and make a remote loopback for this tributary. There should not be any error during one minute.

From the local terminal in super user mode, select the menu "**Tools/Diagnostic Tools/Equipment Forcing"** to access to the manual switching mode (refer to Chapter 3 section 3.3.7.2).

Select standby receiver by clicking on the **Rx2 case**, and validate.

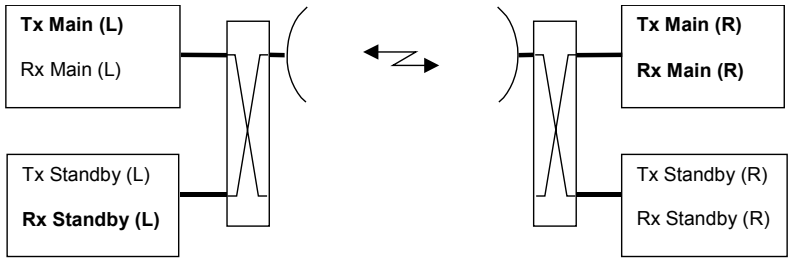

Figure 2.3 : Main local transmitter and standby local receiver active

This switching should be error free. Wait one minute to verify the transmission is error free.

From the local terminal, in the same menu, select standby transmitter by clicking on the case "**Tx2**". This switching causes errors. However the switching time should be less than 2 seconds (less than 2 x 10^6 errors).

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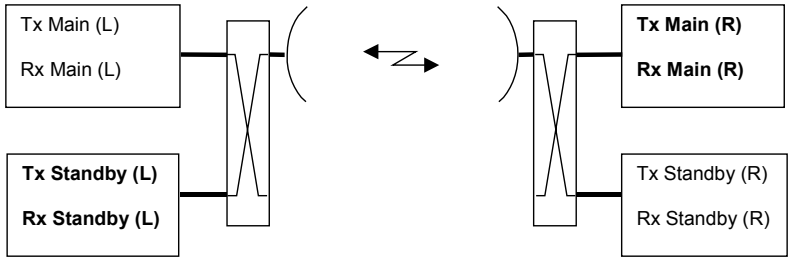

Figure 2.4 : Standby local transmitter and receiver active

Clear the counter, and verify there is no error occurred during one minute.

If a revertive switch is used, from the local terminal select "**Auto**" for both transmitter and receiver. Main local ODU should be now active.

If there is no revertive switch selected, select Rx1 and Tx1 in manual mode and validate. Then click on the "Auto" cases.
The system is now in automatic mode, and the maintenance LED should be off.

Note : During transmitter switch from standby to main, errors are also generated.

Use the same procedure from the remote end of the link.

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2.9 - BER Measurement

This test is to be done from one side of the link with all tributaries linked with a daisy chain arrangement as described in Figure 2.5 and Figure 2.6.

In case of a problem due to an interferer, it should be necessary to measure the two directions separately and to proceed to a frequency scan.

For a 1+1 system, as the verification of the different units have already been made, the quality test shall be performed only with main channels (automatic mode).

A BER test using G821 parameters shall be performed for a duration depending on the network :

- 30 minutes for low capacity links (GSM, Wifi,…)
- 24 hours for medium and high capacity links

An other amount of time could be used for this test, but this will require Sagem approval.

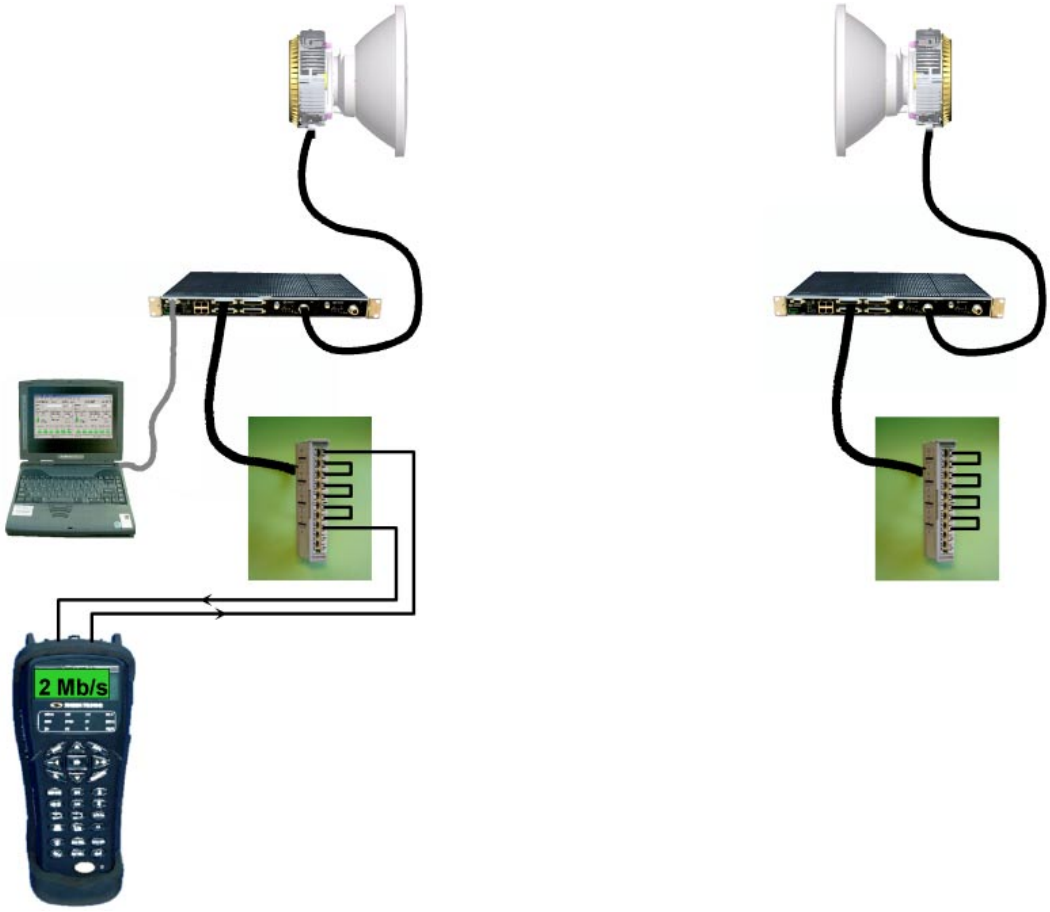

Figure 2.5 : Link Quality Measurement

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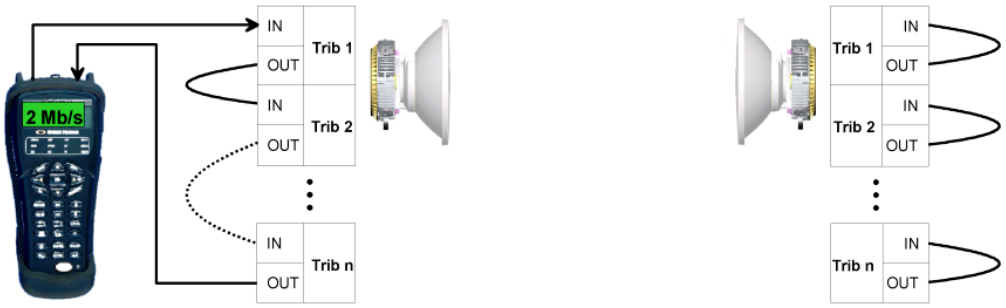


Figure 2.6 : Tributary daisy chain connections

The BER tester shall be configured as follows :

- 2 Mbit/s data rate, HDB3, with a 2^{15}-1 sequence, using the same impedance than selected in the IDU.
- Run the test for the required amount of time
- Depending on the BER tester used, results could be transfered electronically to the PC via a serial port in a file. If it is not possible, the results shall be printed on paper.

Once all these tests have been completed, do not forget to remove tributary daisy chain arrangement.

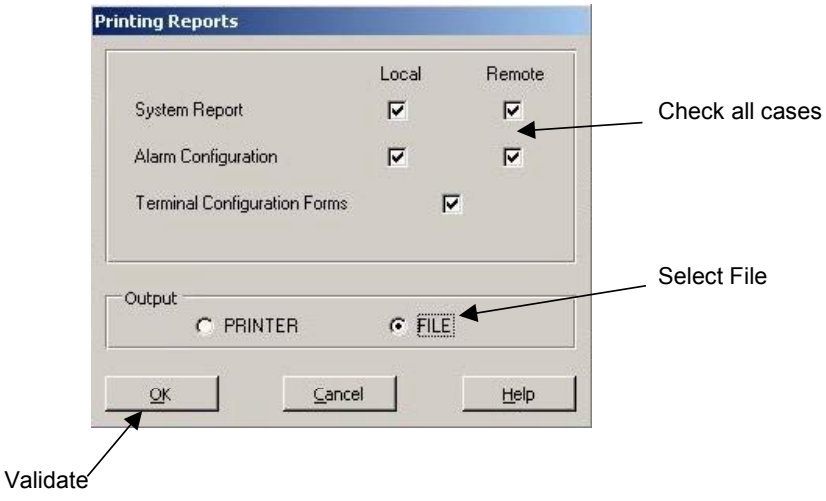
The system is now ready to operate with traffic connected. If any test have failed to meet specifications, consult the troubleshooting chapter in this manual.

2.10 - Recording Configuration Information

This procedure explain how to get all necessary information from SAGEM LINK F equipment to be attached with Sagem Link F Field Commissioning Form.

Connect the computer to the local IDU and run the Sagem Link F Pilot software in super user mode (default password : "2345")

Link Configuration Information :
From the main screen, open the menu "**Configuration/Print"**, this screen appears :



Save the file in the PC using a name including site names :

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"Name of local site – Name of Remote site.txt".

This file is a text file describing local and remote configuration, with information regarding hardware and software involved (part numbers, manufacturing date, versions…).

Saving Local and Remote Configuration

Local and remote configurations can be saved in data files. In case of a replacement of a unit, previous configuration can be restored easily.

To save local or remote configuration use the menu, :
"**Configuration/Save as/Local** or **Remote**". Chose a name for the configuration files like :

"Name of local site – Name of Remote site.slf", for the local terminal and
"Name of Remote site – Name of Local site.slf", for the remote terminal.

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SAGEM	SAGEM LINK F Field Commissioning Form	Page 1/2

Customer Information :

Link Name :

Date :

Terminal Configuration :	❑ 1+0	❑ 1+1 HSB	❑ 1+1 SD	❑ 1+1 FD
Capacity / Modulation :	❑ 2xE1 / QPSK	❑ 4xE1 / QPSK	❑ 8xE1 / QPSK	
	❑ 16xE1 / QPSK	❑ 8xE1 / 16QAM	❑ 16xE1 / 16QAM	

Local Site	Remote Site
Name :	Name :
Antenna Type :	Antenna Type :
IDU to ODU Cable Length :	IDU to ODU Cable Length :
Transmit Frequency :	Transmit Frequency :

1.1.1.1.1.1.1.1 TEST DATA

Local Site				Remote Site			
Input DC Voltage : VDC				Input DC Voltage : VDC			
RSL at ODU access (dBm)				RSL at ODU access (dBm)			
	Measured	Expected	Difference		Measured	Expected	Difference
Main				Main			
Standby				Standby			
Tributary Tests : ❑ Pass ❑ Fail				Tributary Tests : ❑ Pass ❑ Fail			
E.O.W. * : ❑ Pass ❑ Fail				E.O.W. * : ❑ Pass ❑ Fail			
Alarms & Loops* : ❑ Pass ❑ Fail				Alarms & Loops* : ❑ Pass ❑ Fail			
1+1 Operation* : ❑ Pass ❑ Fail				1+1 Operation* : ❑ Pass ❑ Fail			
Bit Error Tests				Bit Error Tests			
Test Duration : Number of Errors : ❑ Pass ❑ Fail							

*** Note : Optional**

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SAGEM	SAGEM LINK F Field Commissioning Form	Page 2/2

Attached Electronic Documents
❑ Floppy Disk ❑ CDROM ❑ Other
Reference(s) :
❑ Configuration information file from the menu "Configuration / Print"
❑ Configuration file from the menu "Configuration / Save As / Local"
❑ Configuration file from the menu "Configuration / Save As / Remote"
❑ BER Measurement file
❑ Other :

Notes

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Chapter 3

Sagem Link F Pilot Description

3.1 - Overview

This chapter describes Sagem Link F Pilot software which is the Graphical User Interface used to control all SAGEM LINK F operations. It provides information on using, starting and exiting the SLF Pilot and on understanding all features.

First, all necessary operations to start and to configure a link are presented. In a second part of this chapter all menus are described.

The SLF Pilot allows the user to :

- View local and remote terminal configuration
- Set and change parameters on local and remote terminals
- Monitor RSL, BER and alarms
- Download and activate a new firmware version
- Perform specific installation and maintenance operations
- Set network management configuration

Software environment

The SLF Pilot is run on a PC with the following minimum configuration :

- Operating System : Windows 2000 or Windows XP
- Pentium 4 or above, 1 GHz minimum
- Memory 256 Mbytes of RAM
- 50 Mbytes available on hard disk
- CD ROM drive
- One serial port COM1 to COM4 (or USB port + serial to USB adapter)
- A SVGA Screen, with 600 x 800 minimum resolution (16 colors minimum)

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3.2 - SAGEM LINK F Pilot : Main Operations to Configure a Link

This section describes all operations to configure main parameters of Sagem Link F radios. Main topics covered are :

- Installing the SAGEM-LINK F Pilot Software
- Connecting the laptop to SAGEM-LINK F IDU
- Link Preliminary configuration
- Completing Link Configuration

3.2.1 - Installing the SAGEM – LINK F Pilot Software

Insert SAGEM LINK F CD-ROM into the drive. SLF Pilot software is launched automatically, if the CD-ROM drive has been configured with the "Autorun" option.
If the program does not start automatically, use Windows Explorer and run the "setup.exe" file. Installation is automatic, and does not require any manual configuration. SLF Pilot can be run by double clicking on the shortcut.

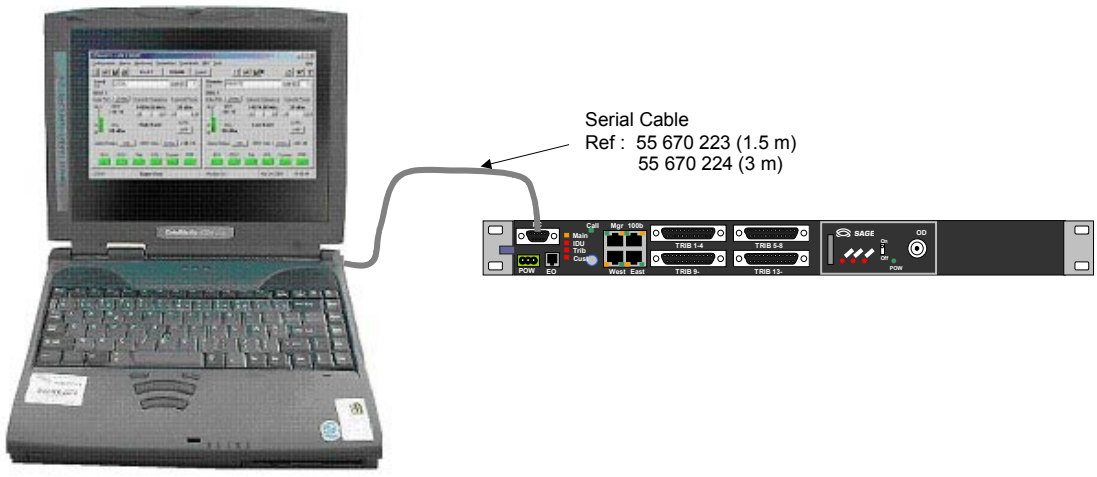
Note : if the computer has no serial port available, it is necessary to use an USB-serial port adapter. SAGEM LINK F Pilot application requires a COM port between 1 and 4. If you use a different COM port, SAGEM LINK F equipment will not be recognized by the SLF Pilot.

In order to check what COM port has been affected by Windows after adapter installation, go to the Control Panel / System / Hardware / Device Manager/Ports (COM & LPT) and click on the COM and LPT icon.
Click with the right button on the icon corresponding to your USB – serial adapter, and select "Properties". Then select the tab "Port Settings" and click on the button "Advanced".
On this screen you can see what COM port is currently used for the adapter.

If the adapter has been affected on a COM port which is not comprised between COM1 and COM4, then change the COM port number to a number between 1 and 4. If there is not an available COM port in this range, it should be necessary to disable one existing port and to affect it for the adapter.

3.2.2 - Connecting the Laptop to SAGEM – LINK F IDU

Connect the laptop to the "PC" port of a SAGEM LINK F IDU using a serial RS232 cable.



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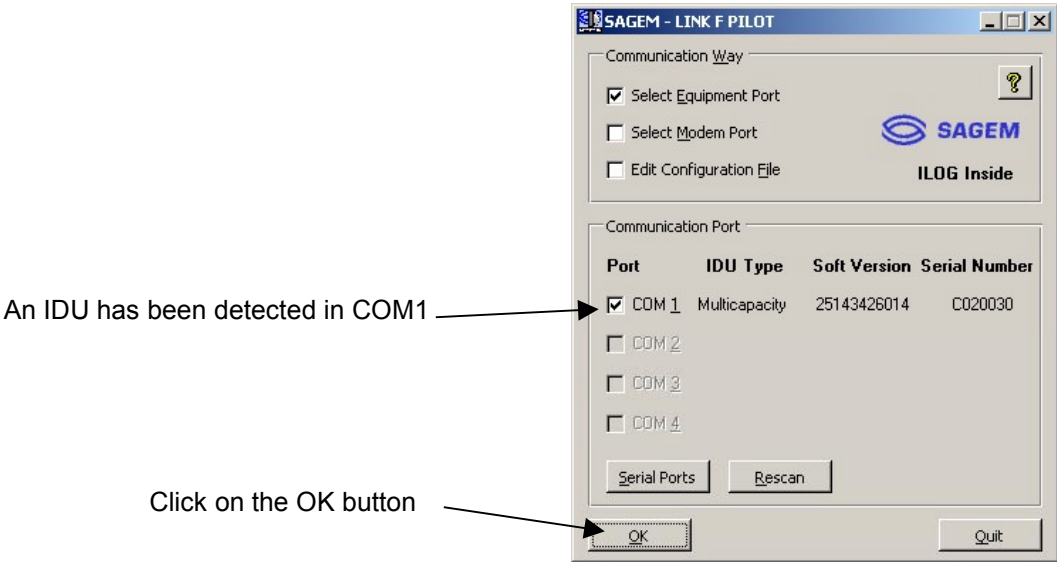
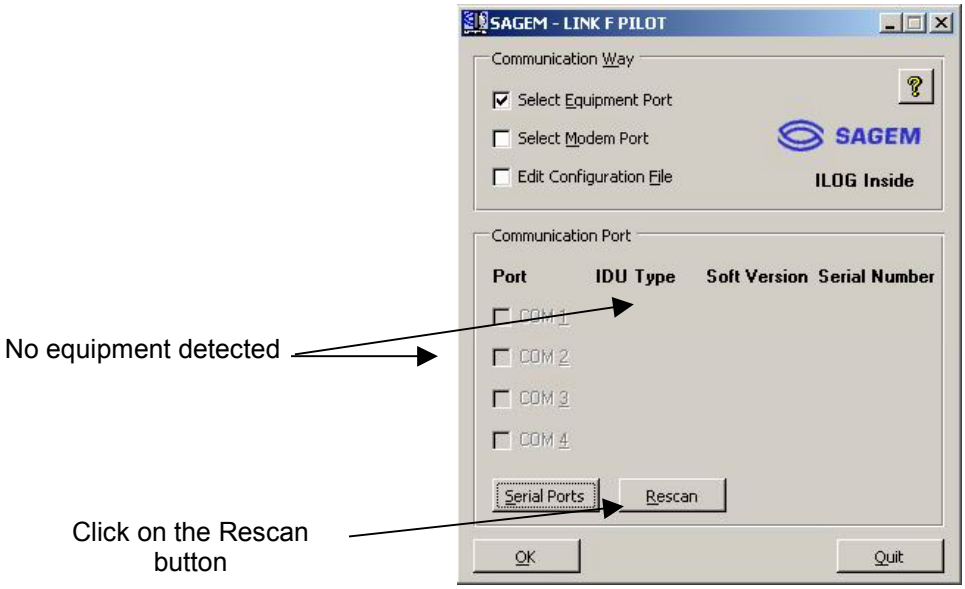
The IDU is connected to its ODU, and to a DC power supply. Switch on the IDU with the switch in front panel and run the SAGEM LINK F Pilot software.
The following screen appears :



When an IDU is detected, then the port, the IDU type, the software version and the serial numbers are indicated on the first screen. In order to access to SLF Pilot main screen, click on the OK button.

If the following screen appears without any indication, then it means the equipment is not properly connected, or not powered, or PC COM port is not properly configured.



Check if IDU is powered, if PC cable and COM settings are good, and click on the "Rescan" button.

3.2.3 - Link Preliminary Configuration

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The first link configuration is made separately at each end of the link. If the link has been previously established, then it is possible to configure dynamically parameters only from one side of the link.

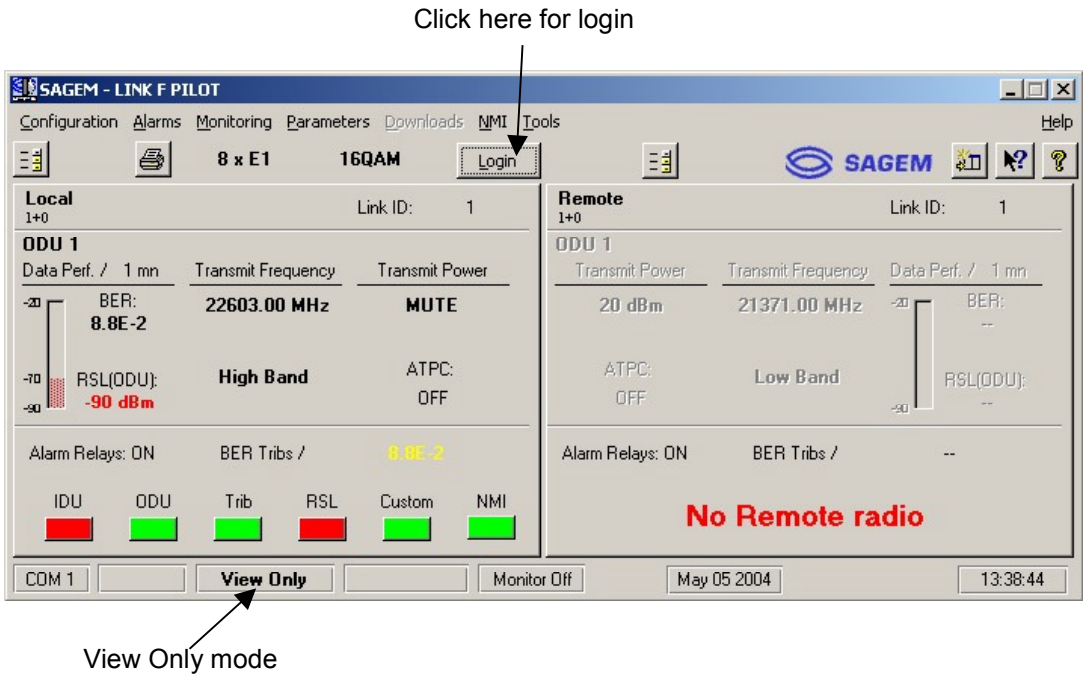
The first essential parameters to configure before establishing the link are :

- Channel Transmit Frequency
- Modulation and Capacity
- Transmit Power (ATPC should be in "OFF" position at this time)
- Link ID Code

Note : When powering up terminal for the first time, transmitter should be in "MUTE" position, in order to avoid any interference with other radios while configuring the equipments.

It is necessary to keep transmitter in mute position until transmit frequency, modulation and capacity are properly configured.

When the link is not established, the main Pilot screen indicates "No remote radio" on the right side of the screen. An example of a typical screen is given below :



Local terminal parameters are on the left part of the screen, while remote terminal parameters are located on the right side.

On the top of the screen, current capacity and modulation are displayed. Below are terminal configuration and Link ID code.

On the middle part of the screen BER indication, Receive Signal Level (RSL), Transmit frequency, Transmit Power, and ATPC status are indicated.

On the bottom of the screen, main alarms are displayed.

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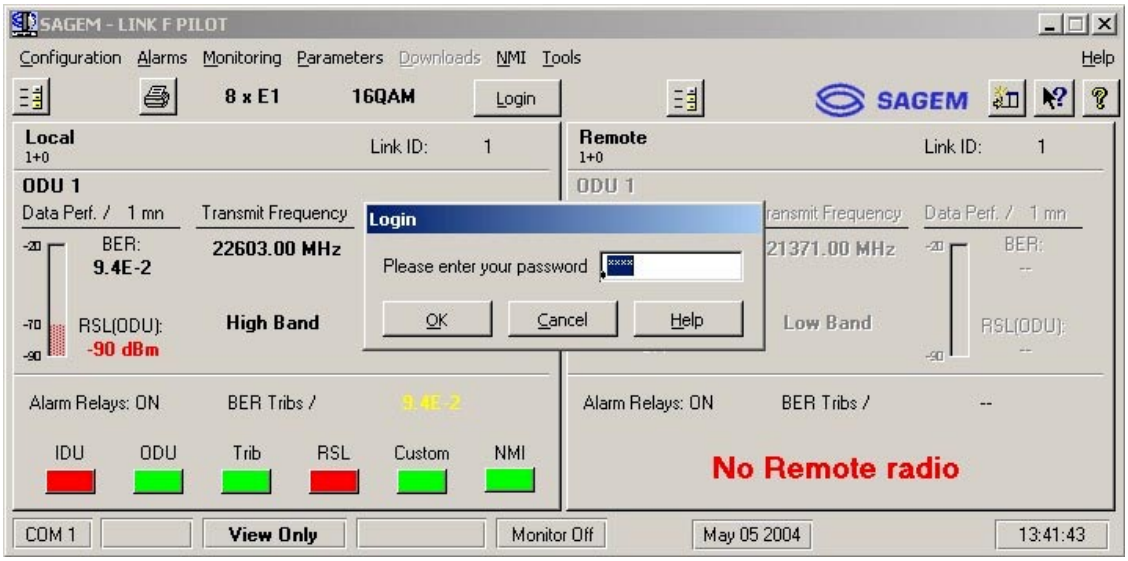
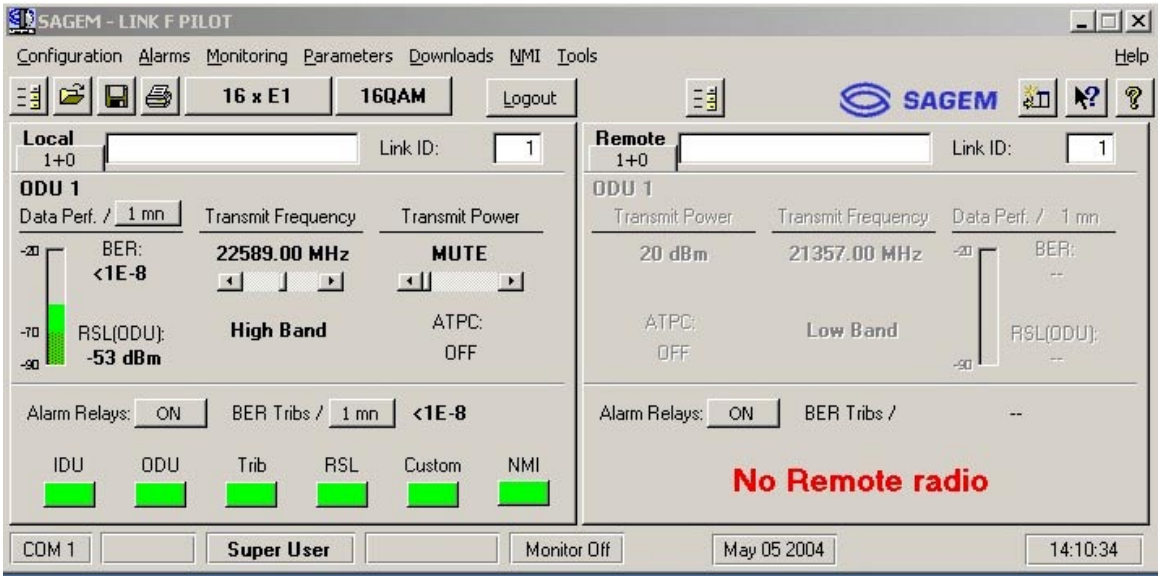
Click on the "Login" button and enter the password "**1234**" corresponding to a user level or "**2345**" corresponding to a super user level (default passwords).

Validate by clicking on the OK button.



The main screen with a super user login is given below. Some button are now present. Each button allows the user to modify a specific parameter.

Note that only one change at a time is allowed.



When changing a parameter, use the button to validate the change, or the button to cancel.

By default, a warning screen appears to confirm again the choice.

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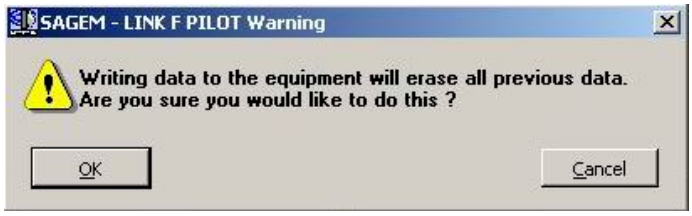
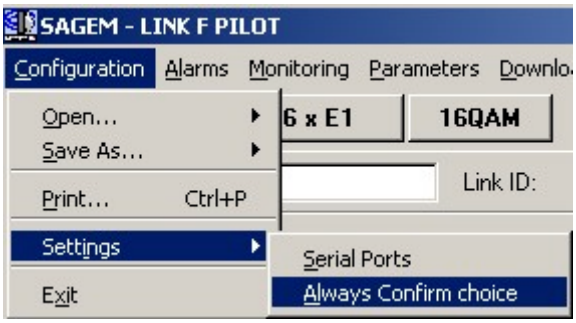
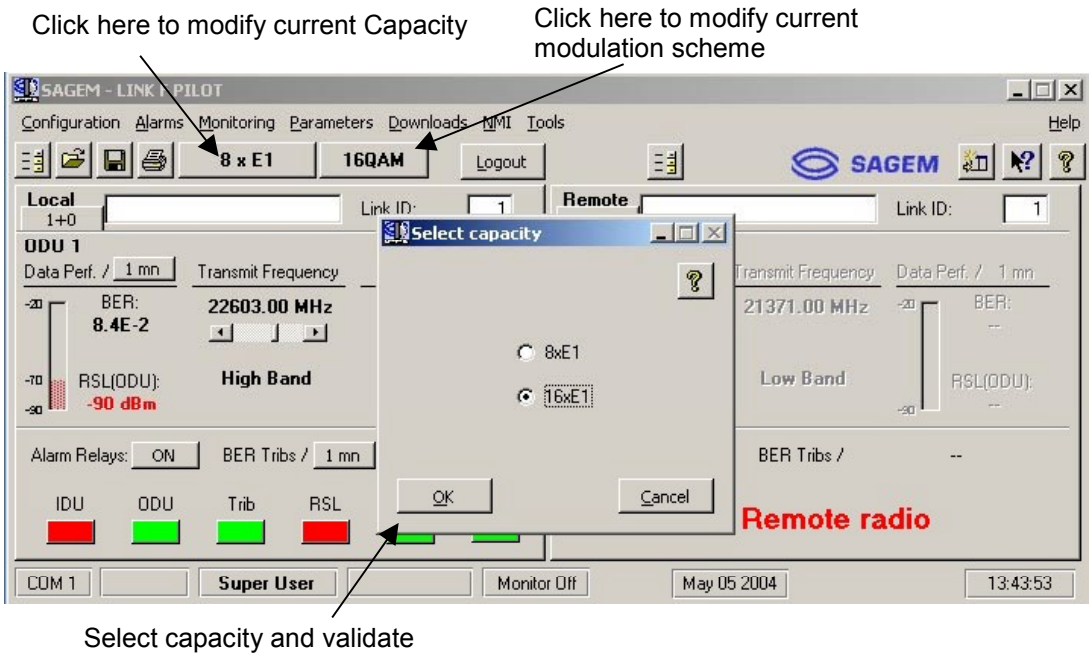

SAGEM - LINK F PILOT Warning
Writing data to the equipment will erase all previous data.
Are you sure you would like to do this ?
OK
Cancel

For advanced users who may want to remove this confirmation, use the menu **Configuration / Settings** and uncheck "**Always confirm choice**"



While transmitter is still in mute position, change if necessary :

- **Transmit frequency** by moving the cursor on the slide , or by clicking on the left or right buttons, and validate
- **Capacity**



Note : as capacity ranges are not the same in QPSK mode (2xE1, 4xE1, 8xE1 or 16xE1) than in 16QAM mode (8xE1 or 16xE1), it should be necessary to change first modulation then capacity or the opposite depending on the current and target configurations.

- **Modulation** (only if 16QAM option is installed) : click on the modulation button (toggle between **QPSK** and **16QAM**.

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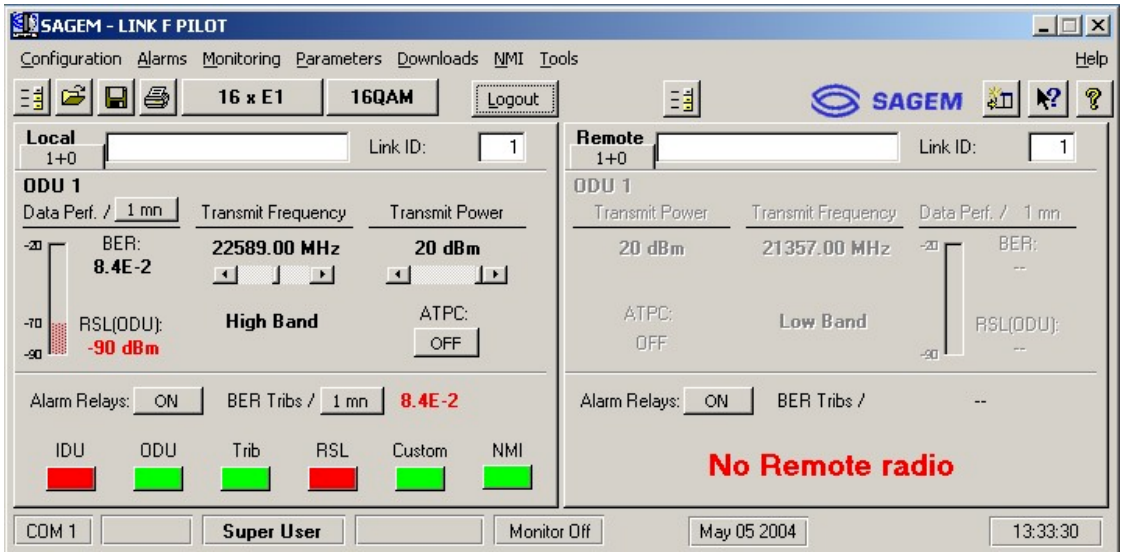
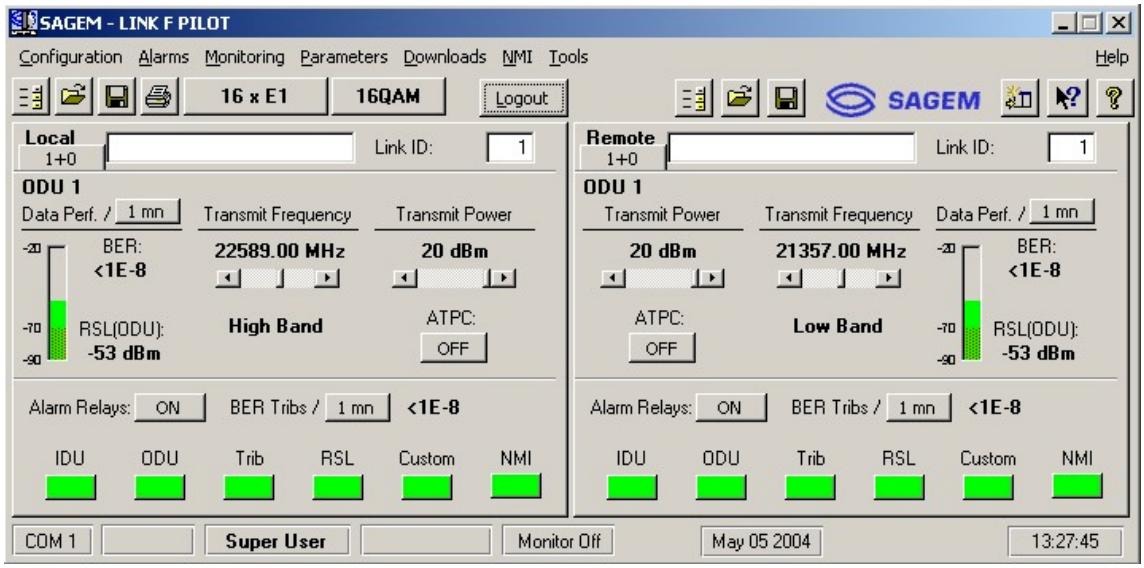
- **Link ID Code** : this code is used to identify the link and to avoid data recovery from an other link at the same frequency. Link ID Code of the local and remote terminals must be the same.

Once these settings are completed, remove the mute by clicking on the transmit power slide, and select the wanted transmit power. Verify that ATPC is still in "OFF" position.

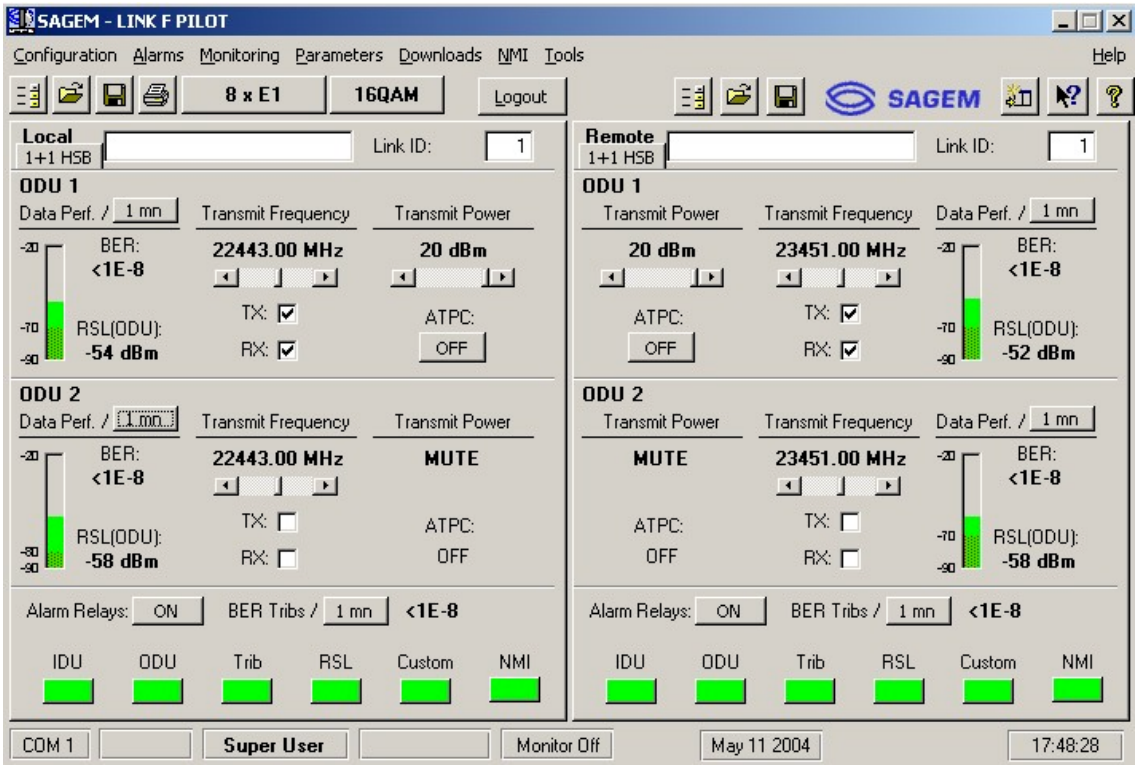


The terminal is now ready for transmission, it is necessary to repeat the same operations with the remote terminal to establish the link.

Normally, if main parameters are compatible and if there is enough receive level, the link should be established, and the main Pilot screen of the local terminal should look like that :



Main Pilot Screen for a 1+0 Configuration



Main Pilot Screen for a 1+1 Configuration

Note : Depending on the previous configuration, some alarms may still be present (Trib or Custom).

3.2.4 - Completing Link Configuration

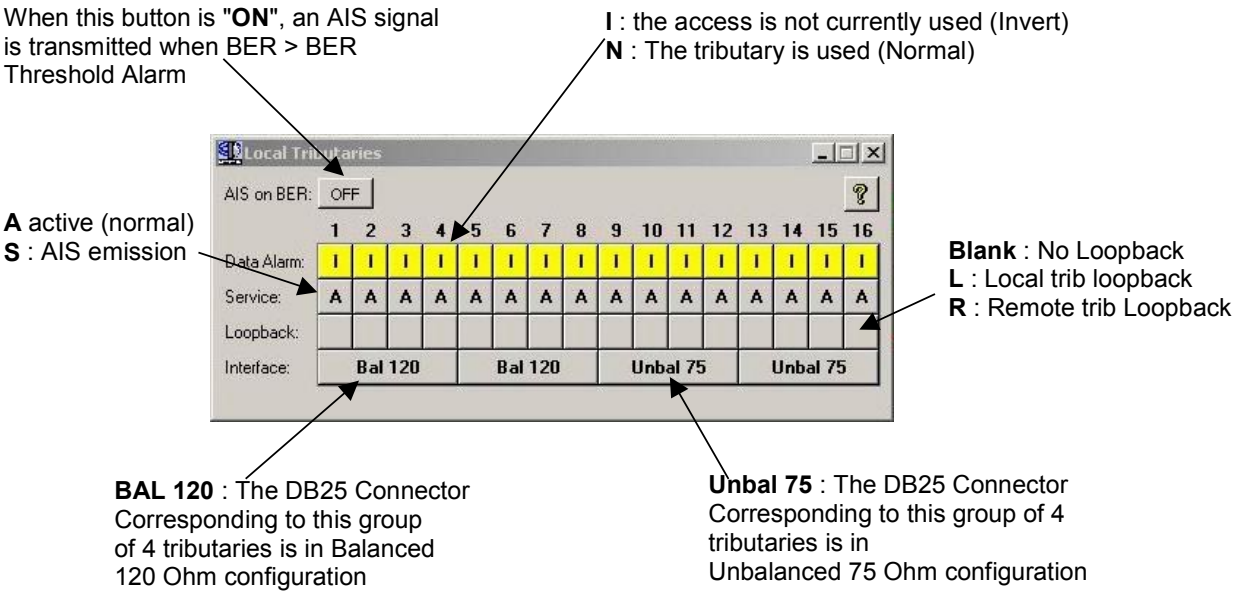
Once the link has been established with the right main parameters, it is necessary to complete the installation. The remaining parameters to adjust are :

- Local and remote tributaries configuration (alarms, impedance)
- Site names
- BER counting period
- Setting Alarm thresholds (BER, RSL)
- Alarm relays configuration
- Auxiliary channels configuration
- Automatic Transmit Power Control (ATPC)
- Network Management Interface Parameters (if available)

3.2.4.1 - Tributary Configuration

Click on the button (top left (local) or top right (remote) of the toolbar on main screen) or use the **menu "Tools / Tributaries / Local or Remote"** to open tributary configuration window.

This screen may vary depending on the current capacity. Below is an example for 16xE1 capacity.


When this button is "ON", an AIS signal is transmitted when BER > BER Threshold Alarm
I : the access is not currently used (Invert)
N : The tributary is used (Normal)
Local Tributaries
AIS on BER: OFF
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Data Alarm: I I I I I I I I I I I I I I I I
Service: A A A A A A A A A A A A A A A A
Loopback:
Interface: Bal 120 Bal 120 Unbal 75 Unbal 75
A active (normal)
S : AIS emission
Blank : No Loopback
L : Local trib loopback
R : Remote trib Loopback
BAL 120 : The DB25 Connector Corresponding to this group of 4 tributaries is in Balanced 120 Ohm configuration
Unbal 75 : The DB25 Connector Corresponding to this group of 4 tributaries is in Unbalanced 75 Ohm configuration

Change the different settings by clicking on the corresponding button.

- **AIS on BER** : when selected, an AIS is sent to the tributary output in case of a BER greater than 10^{-3}.
- **Data Alarm** :
  - if the tributary is not currently used for traffic, then it is necessary to configure it as **inverted** (I). In this mode, there will be no tributary alarm for this particular tributary if it is not connected. However, if this tributary is connected while being in "I" position, a tributary alarm is generated.
  - If the tributary is used for traffic, it is necessary to configure it as **normal** "N". In this mode there is an alarm in case of lack of signal at tributary input.
- **Service** : for normal service select "**A**" (active). If you select "**S**", an AIS is returned to the receive tributary on the local terminal (this AIS is not being transmitted on the remote terminal).

- **Loopback** : when clicking on a button located on the loopback line, the following screen appears :

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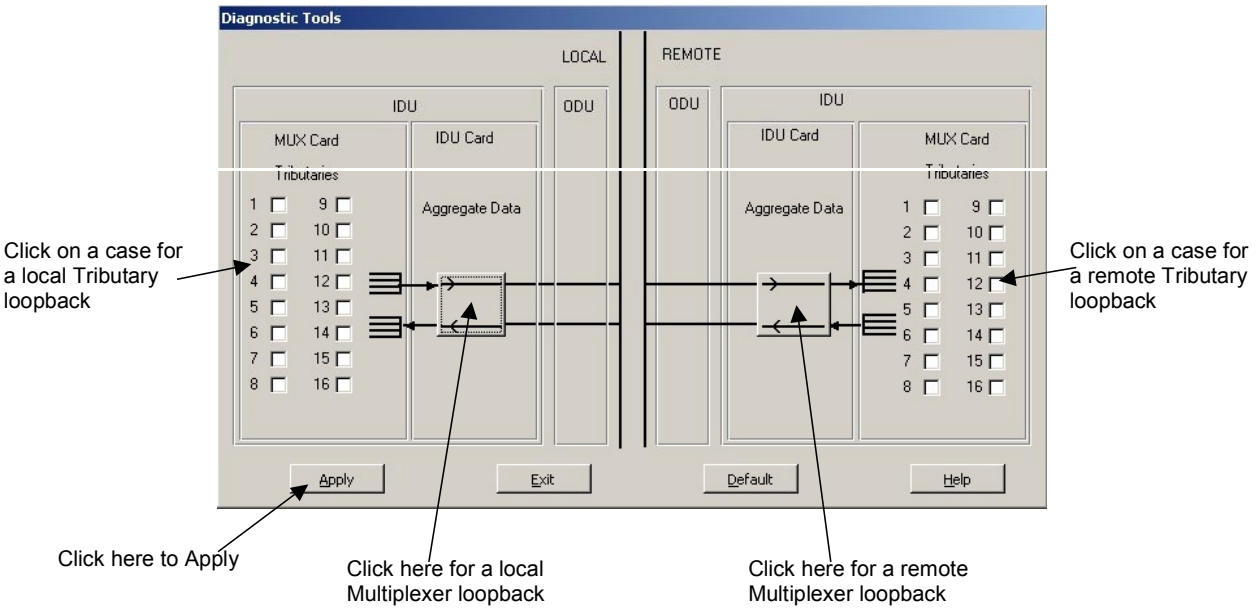
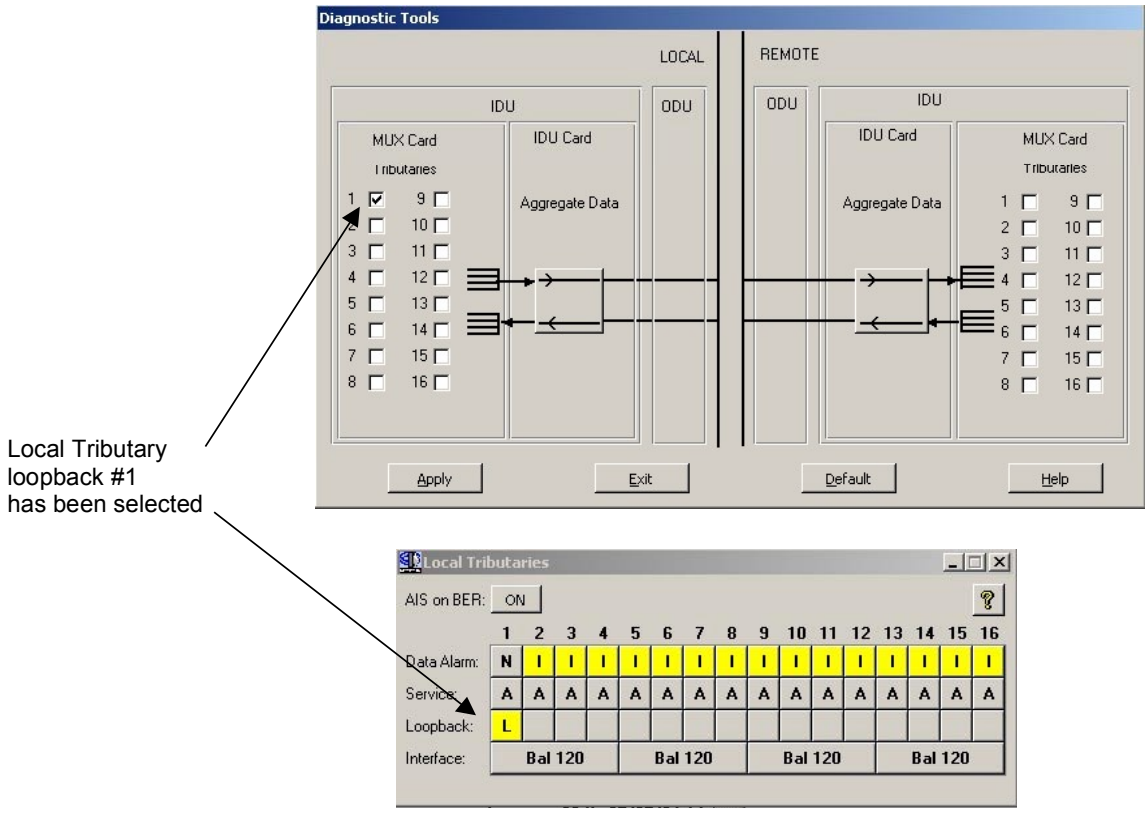


From this screen it is possible to control a local or a remote tributary loopback, or a local or remote multiplexer loopback.

Tributary Loopback

When a tributary loopback has been selected, then a Maintenance indication is written on the status bar of the main Pilot screen, and the yellow LED "Maint" in IDU front panel flashes.



The local and remote loopback operations are explained in the diagram below :

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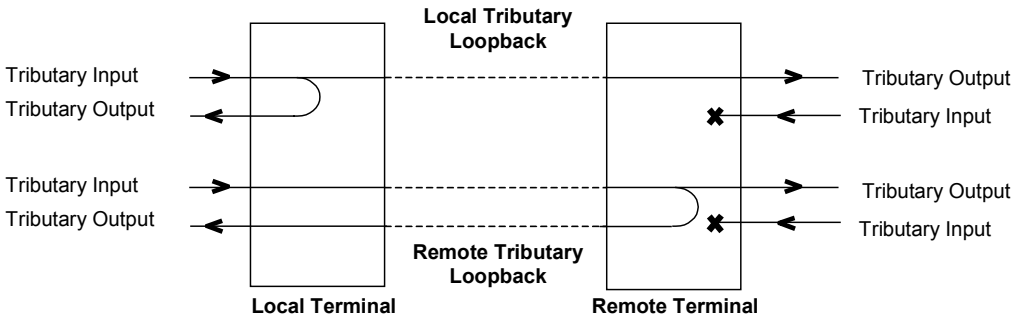


A local tributary loopback is used to check a connection to the local terminal. A remote tributary loopback is used to check link transmission.

Multiplexer Loopback

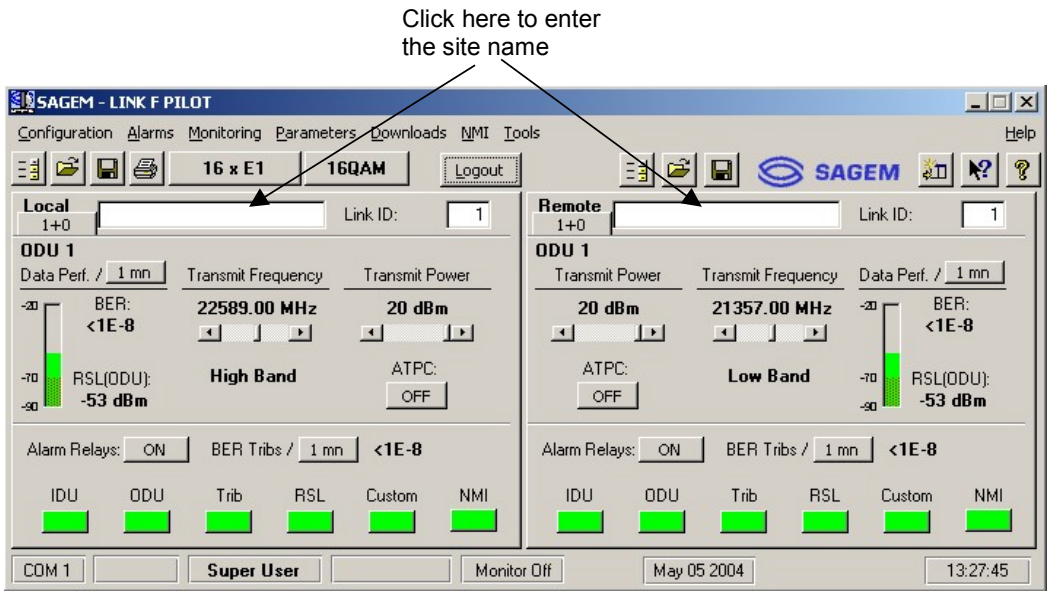
A Multiplexer Loopback is a loopback at multiplexer level (aggregate data rate). All input traffic is returned to the output.

Multiplexer loopbacks work in the same way as tributary loopbacks. These loopback are used to controlled multiplexer proper operation.

- **Interface** : Each DB25 connector including 4 tributary Input / Output, can be configured as balanced 120 Ohm interfaces, or as unbalanced 75 Ohm interface. Click on the corresponding button and validate the change.

3.2.4.2 - Entering Site Names

When logged as a user or a super user, enter a site name for the local terminal or for the remote terminal



3.2.4.3 - Configuring BER Counting Period

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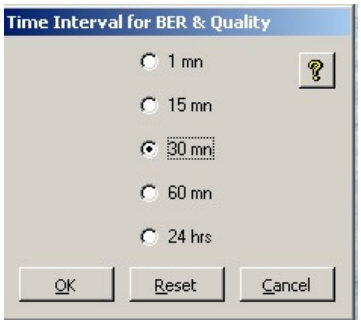
The BER counting period can be adjusted by clicking on Data Perf buttons or on the BER Tribs buttons.

The following dialog box appears :



Choose a time interval and validate.

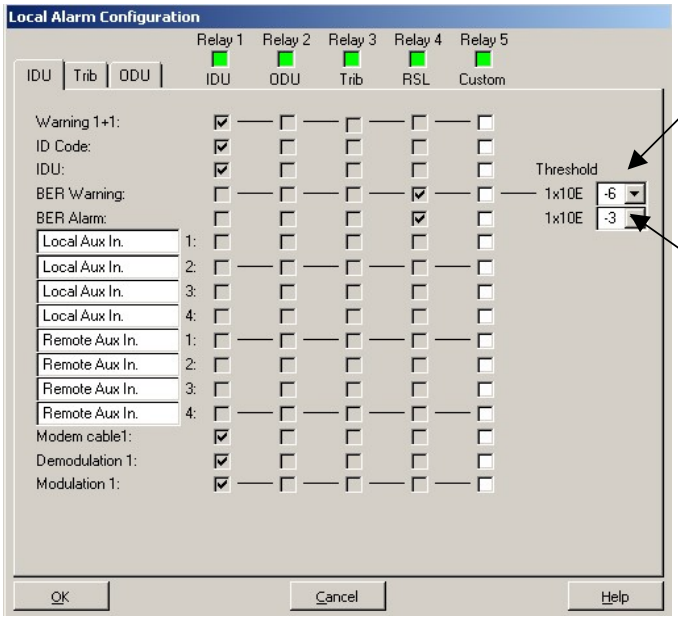
- Use the **Reset** button to clear BER counter and to start a new measurement.
- A BER counting period modification does not reset automatically the BER Counter. The errors are recorded over a 24 hours period in IDU memory. When choosing a period, only errors occurred in the selected duration prior to the request are displayed.

3.2.4.4 - Setting the Alarm Thresholds

BER and RSL alarms thresholds can be adjusted with the Pilot software.

BER thresholds : use the menu **Alarms / Config / Local**, and select the **IDU** tab. Two BER thresholds are available : BER Warning (default : 10^{-6}) and BER Alarm (default 10^{-3})

Note these thresholds may be modified (between 10^{-3} and 10^{-6}). Unless specific requirement, it is advised to keep the default threshold figures.



RSL threshold : use the menu **Alarms / Config / Local**, and select the **ODU** tab.

The receive level threshold must be within –60 dBm to –80 dBm range (default : -70 dBm).

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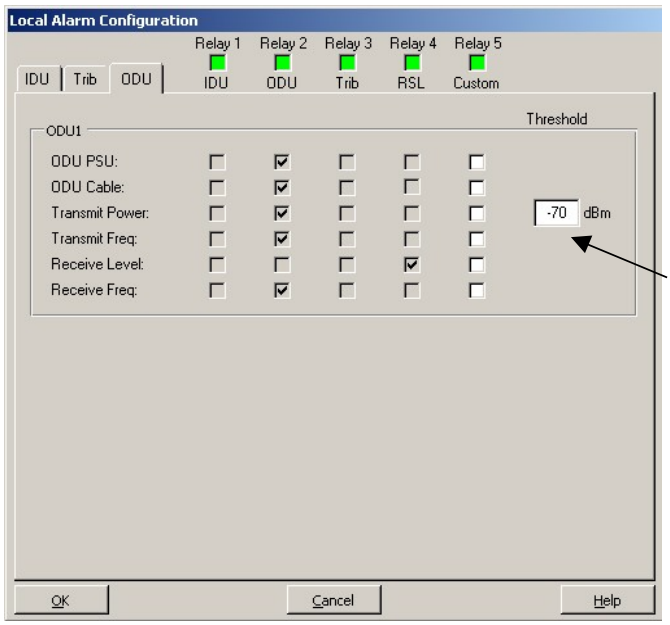
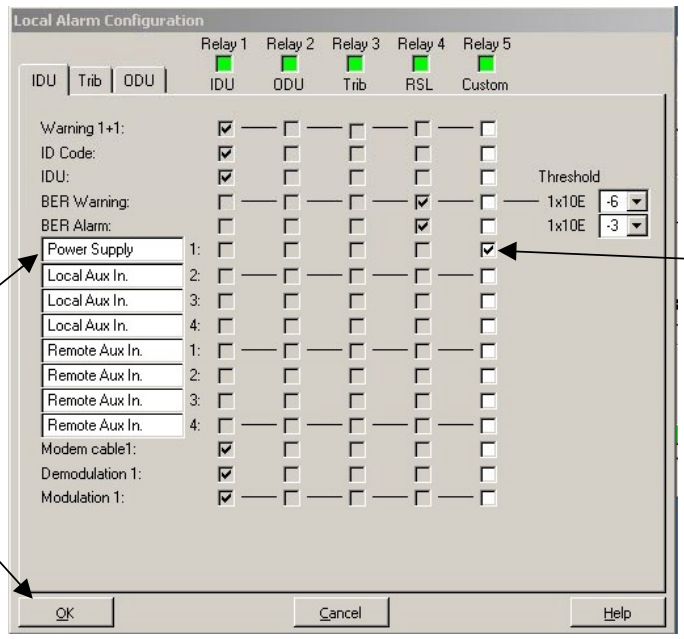


RSL Threshold Choose Threshold between -60 and -80 dBm

3.2.4.5 - Setting the Custom Alarm Relay

A custom alarm is available and can be used to monitor internal or external alarms. The following screen explains how to configure this alarm.



Enter an Alarm name

Validate

Affect Local Loop 1 on custom Alarm Relay

Once the custom alarm relay has been configured, the following message appears :

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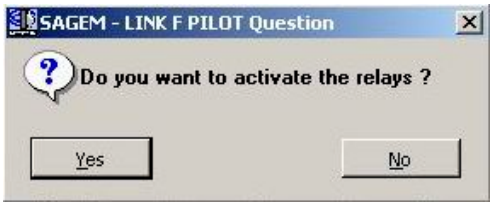
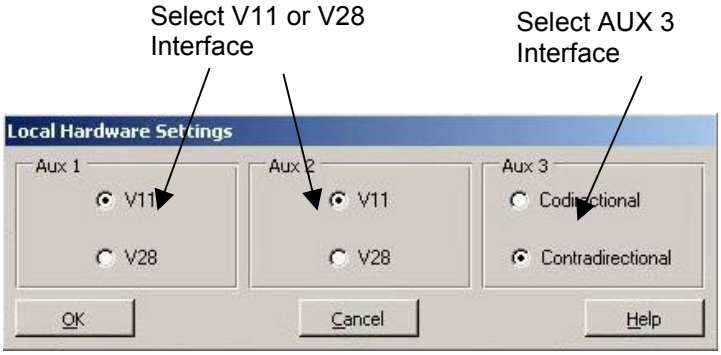


Click on the Yes button to activate the relays, or on the No button to disable the relays. In this case, alarm relays color in main Pilot screen become blue.

3.2.4.6 - Configuring the Auxiliary Channels AUX1, AUX2 and AUX3.

On the main Pilot screen go to the menu **Tools / Config Tools / Equipment Settings/ Local.**



Note : Connector pinout could vary depending on the selected option (refer to chapter1 description).

3.2.4.7 - Configuring the Automatic Transmit Power Control (ATPC).

ATPC is a process which is used to limit transmit power to the minimum necessary while having a good transmission. When ATPC is selected for equipments in a network working in the same frequency band, it allows to increase density and frequency re-use.

ATPC must not be active during antenna alignment process.

ATPC settings depend on the structure of the network (frequency re-use, interferers, link margin). The operator has to define three main parameters :

- Maximum ATPC transmit power
- Minimum ATPC transmit power
- ATPC receiver threshold

Minimum and maximum ATPC transmit powers must be within transmitter power range, and Maximum ATPC Transmit power – Minimum ATPC Transmit Power ≤ 20 dB.

ATPC threshold must be within –50 dBm to –80 dBm range.

The ATPC process consists of reducing transmit power as low as possible within the specified range, without having errors on the remote end, and without having a remote receive level lower than the ATPC threshold.

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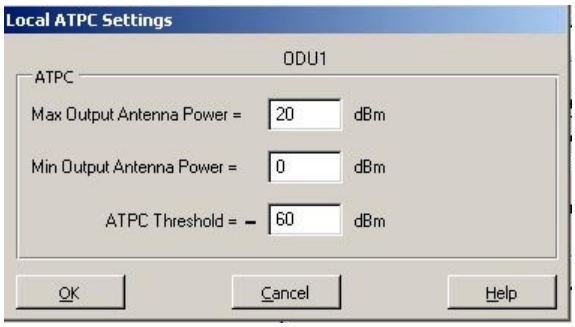
To activate ATPC click on the ATPC button on main Pilot screen. The ATPC button indication is "**ON**" when ATPC works, or "**OFF**" when ATPC is disabled.

To configure ATPC, use the menu **Tools/Config Tools/ATPC/ Local (or Remote)**



Enter the three parameters and validate with the OK button.

Note : ATPC with 1+1 Hot Standby Systems

In 1+1 HSB systems, ATPC parameters are defined at antenna access. As in most cases, the 1+1 HSB coupler is not symmetric, the transmit power at antenna access depends on the transmitter which is in traffic.

ATPC settings are defined at antenna access for the **main ODU** (ATPC transmit power at antenna access = Main ODU Transmit Power – Coupler Losses.

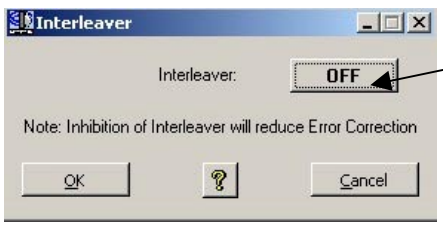
3.2.4.8 - Configuring the Interleaver

If the network requires a low transfer time, it should be necessary to inhibit interleaver features.

Transfer time depend on the data rate. Typical transfer time figures with or without interleaver are given in the table below :

Capacity	Interleaver on	Interleaver off
2xE1	5 ms	1.6 ms
4xE1	2.5 ms	0.8 ms
8xE1	1.25 ms	0.4 ms
16xE1	0.62 ms	0.2 ms

To configure the interleaver use the menu **Tools / Interleaver**. The following dialog box appears :



ON : The interleaver is enabled
OFF : The interleaver is disabled

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Click on the ON/OFF button to configure the interleaver and validate by clicking on the OK button.

Note : if there is no problem with the transfer time, keep the interleaver enabled. This will improve error correction especially if burst errors occur.

3.2.4.9 - Configuring the 1+1 Operation

Static Phase Adjust (Space or Frequency Diversity only)
Systems working in space diversity, or frequency diversity, may require a static phase adjust, in order to compensate the static delay due to the path difference. For hot stand by systems using the same antenna, this adjustment is not required.

To make a static phase adjust, select the menu **: Tools/Diagnostic Tools/Equipment Configuration**, and the following windows appears :

Click on the static phase adjust button to initiate static phase adjustment on the terminal.

Revertive Automatic Switching
When this option is selected, the transmitter and the receiver in traffic are those from the main ODU. If there is a fault on the main ODU (or on the main cable interface), then the switch select automatically the standby transmitter or receiver. When the fault is cleared, there is an automatic return to the main ODU.
This feature is useful when using an asymmetrical coupler for ODU coupling.

When this option is not selected, transmit switch and receive switch position stay on the current position until a fault appears on the transmitter or on the receiver.

Note that transmit and receive switches are independent.

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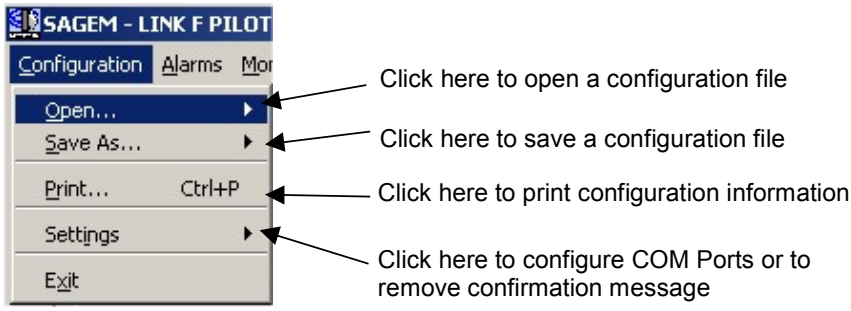
3.3 - SAGEM-LINK F Pilot : Menus Description

This section describes all available menus of SAGEM-LINK F Pilot software in super user mode.

- Configuration Menu
- Alarms Menu
- Monitoring Menu
- Parameters Menu
- Downloads Menu
- NMI Menu
- Tools Menu

3.3.1 - Configuration Menu

When clicking on the Configuration menu, this screen appears :

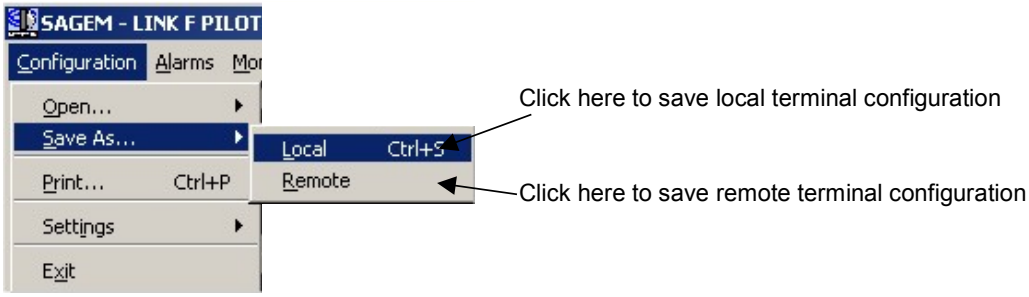


3.3.1.1 - Opening a configuration file

All configuration settings can be saved within a file. When opening such files all configuration parameters are recalled. It is useful to save time in case of IDU replacement.

3.3.1.2 - Saving a configuration file

This menu allows the user to save local or remote terminal configuration into a file.



Note : Always use a .slf extension for these configuration files.

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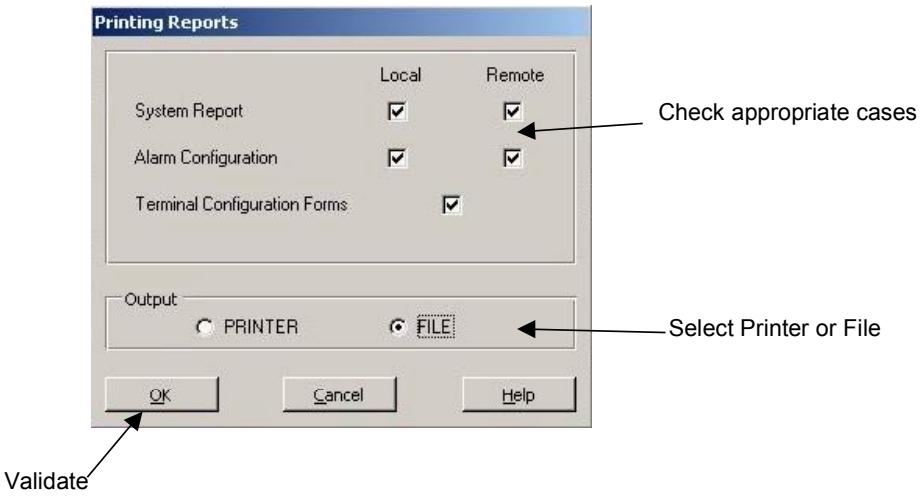
3.3.1.3 - Print

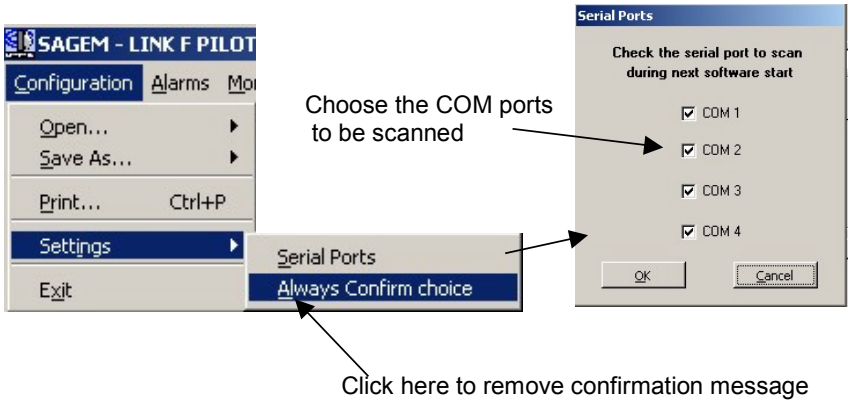
This menu allows the user to print on paper or in a file all configuration data of the link :



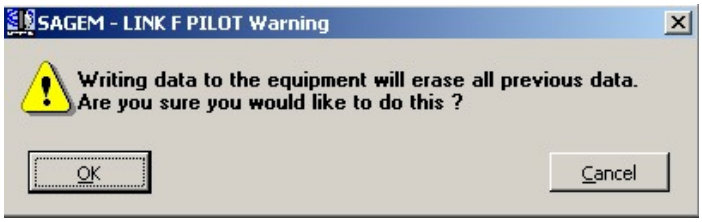
This file includes configuration data, hardware and software details for local and remote terminals.

3.3.1.4 - Configuration Settings

This menu allows the user to specify the COM ports to be scanned when connecting the SAGEM-LINK F to a PC, and to remove confirmation message :

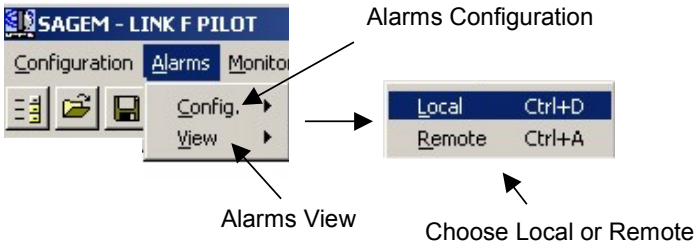


When the "**Always Confirm choice**" is enabled, then the following confirmation message appears :


SAGEM - LINK F PILOT Warning
Writing data to the equipment will erase all previous data.
Are you sure you would like to do this ?
OK
Cancel

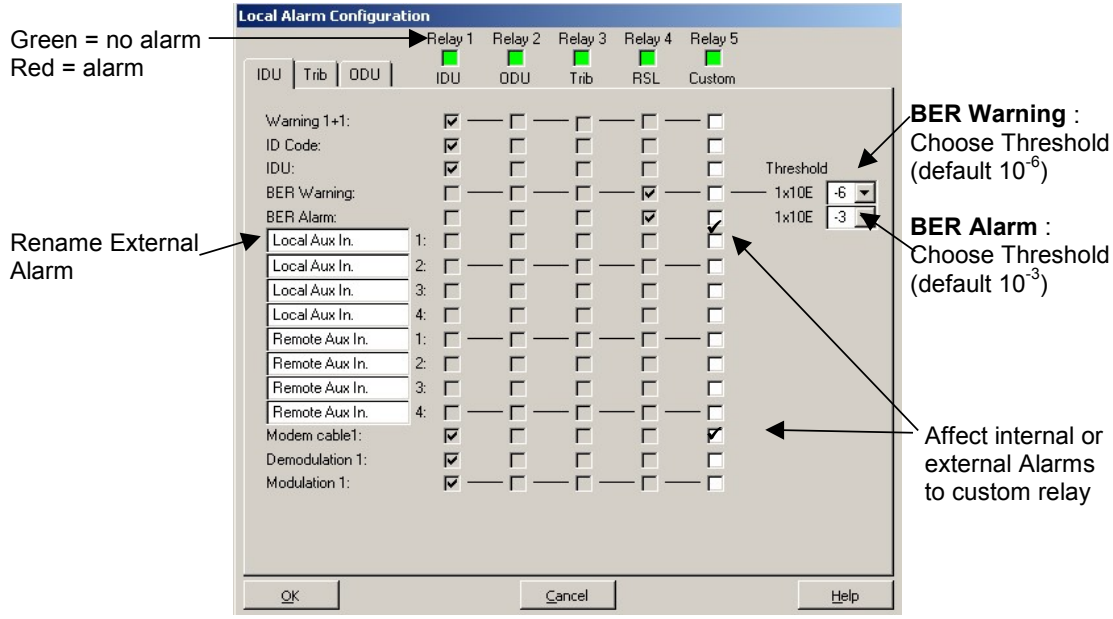
3.3.2 - Alarms Menu

When clicking on the Alarms menu, this screen appears :



3.3.2.1 - Alarms Configuration - IDU

When Clicking on the "**Alarms / Configuration /Local** (or **Remote**)" menu the following screen appears :



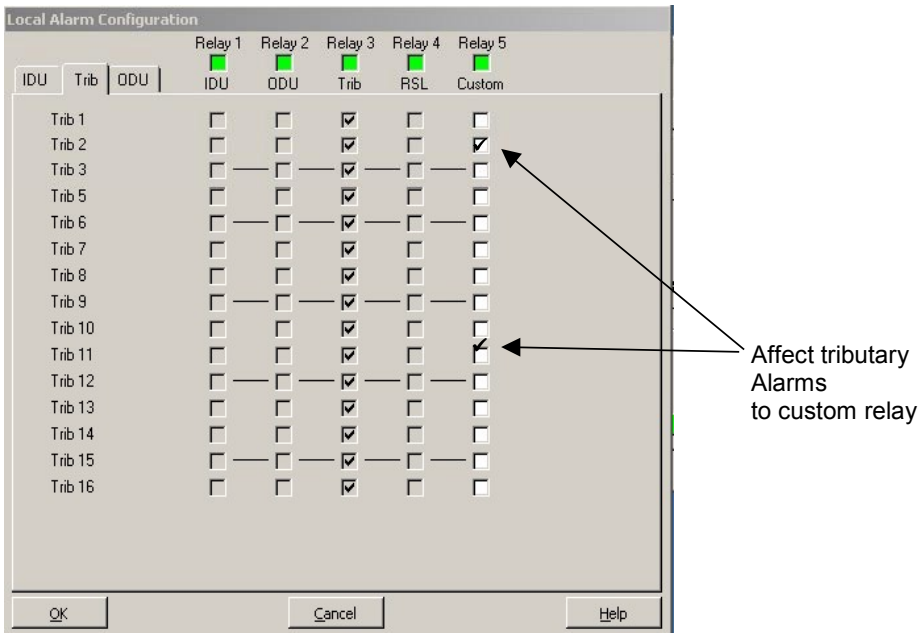
This first screen (IDU Tab) allows the user to :

- Set the BER Warning and BER Alarm thresholds (default 10^{-3} and 10^{-6})
- Affect internal and external alarms to the custom relay
- Rename some external alarms

SAGEM-LINK F can manage up to 4 local external alarms and 4 remote external alarms.
The 4 remote alarms are also available in the local terminal with dry loop interface (3 relay contacts).

3.3.2.2 - Alarms Configuration - Trib

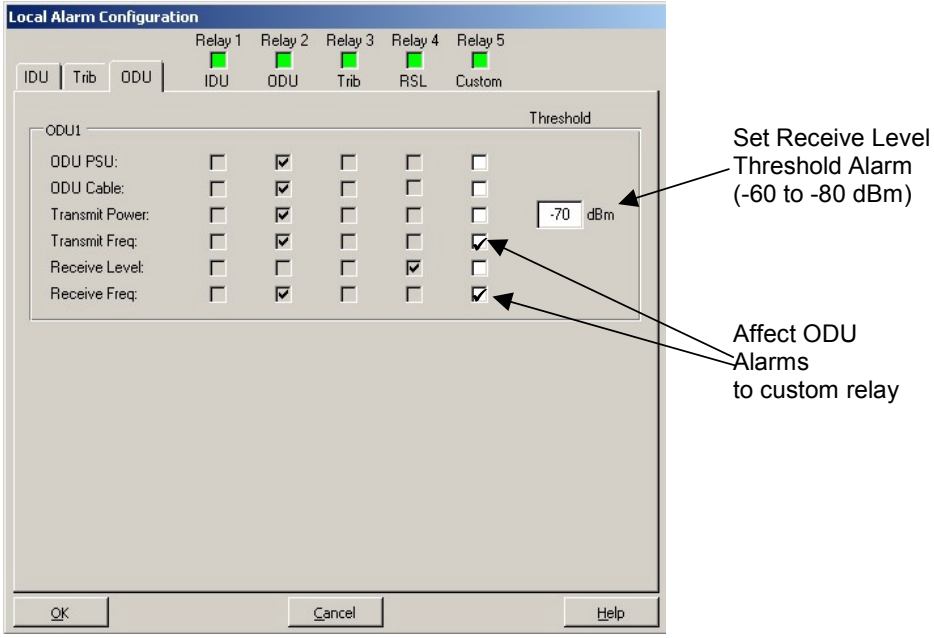
When Clicking on the Trib Tab of the Alarm Configuration menu, the following screen appears :



This screen allows the user to affect one or several tributary alarms to the custom relay.

3.3.2.3 - Alarms Configuration - ODU

When Clicking on the ODU Tab of the Alarm Configuration menu, the following screen appears :



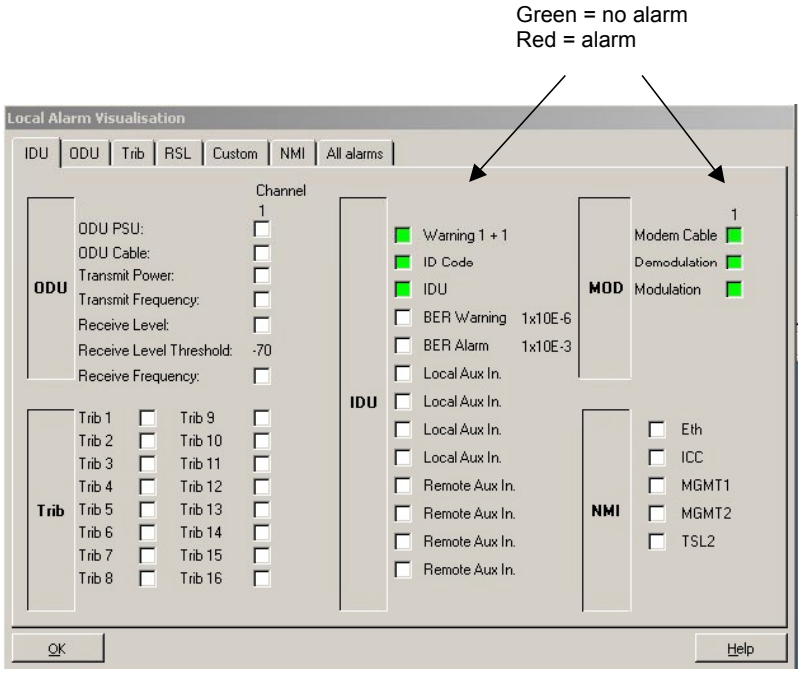
This screen allows the user to affect one or several ODU alarms to the custom relay, and to set the value of receive threshold alarm.
Note that RSL threshold alarm must be within –60 dBm to –80 dBm range.

3.3.2.4 - Alarms View (local or remote)

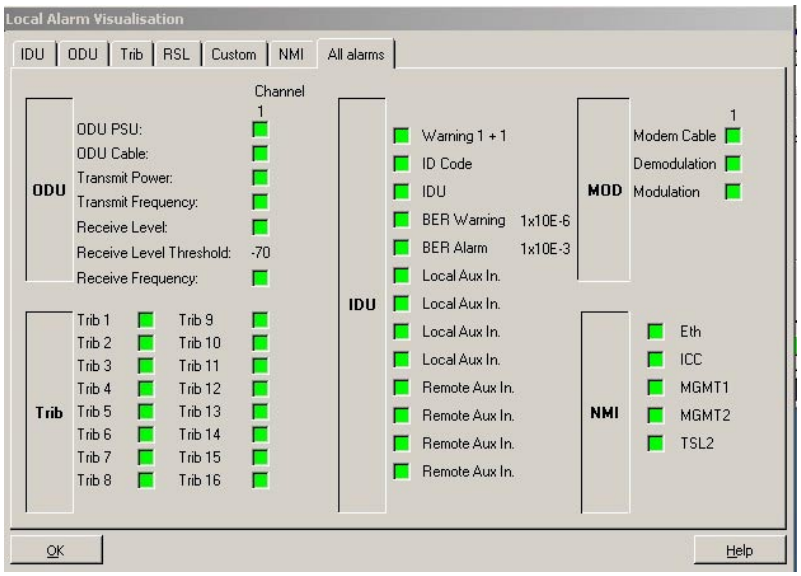
When Clicking on the "**Alarms / View /Local** (or **Remote**)" menu the following screen appears. Select the IDU, ODU, Trib, RSL, Custom, NMI tab to view specific alarms, or select the All alarms tab to have a complete alarm view.

It is possible to access directly to the same menus from the main Pilot screen by clicking on the buttons corresponding to the alarms

(bottom of the screen).



Alarm View – IDU tab



Alarm View – All Alarms tab

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Alarms Description

ODU Alarms

ODU PSU : Power Supply Alarm returned from the ODU. This alarm is active when there is a default in the ODU power supply, or when the DC input voltage at ODU input is too low. In case of an ODU alarm, check DC Power supply, and cable losses.

ODU Cable : ODU Cable Alarm is generated by the ODU in case of a transmit IF level below the limit. In case of an ODU Cable alarm, check IDU to ODU cable losses.

Transmit Power : A transmit Power alarm is generated by the ODU in case of a transmitter AGC loop fault, or in case of a transmitter mute set by the operator (in 1+1 system when both transmitters are in mute position)

Transmit Frequency : This alarm is generated in case of IF or RF transmit synthesizer faults. When this alarm is active, transmitter is also in mute position.

Receive Frequency : This alarm is generated in case of IF or RF receive synthesizer faults.

Receive Level : This alarm is generated when receive signal level is below the receive threshold (default -70 dBm).

Tributary Alarms : a tributary alarm is generated when there is a lack of input signal for a tributary configured as "normal" (N), or when there is a input signal for a tributary configured as "inverted" (I). In case of a tributary alarm, check the corresponding cable, and verify that external equipment is properly connected.

IDU Alarms

Warning 1+1 : A 1+1 warning is generated when the main or the standby units (ODU or cable interface module) is not working properly (alarm or absent).

ID Code : When local and remote ID Code do not match, there is an ID Code alarm generated, and there is a AIS emission on the receive data from the remote terminal. To clear this alarm change the ID Code on one terminal.

IDU : This alarm is active in case of an IDU fault, or in case of problem to recover receive data.

BER Warning : This warning is generated when BER is greater than the BER warning threshold (default 10^{-6})

BER Alarm : This alarm is generated when BER is greater than the BER alarm threshold (default 10^{-3})

Local Aux In Alarms : These alarms represent local terminal input dry loop status.

Remote Aux In Alarms : These alarms represent remote terminal input dry loop status.

Cable Interface (modem) Alarms

Modem Cable : This alarm is generated in case of a modem fault, or a IDU to ODU cable fault, or in case of lack of ODU (IDU to ODU communication link not operating).

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Demodulation : This alarm is generated if there is a demodulator fault or if received data is not recovered.

Modulation : This alarm is generated if there is modulator fault. When a modulation alarm occurs, the transmitter is muted.

NMI (Network Management Interface) Alarms

Eth : This alarm is generated in case of a hardware failure regarding NMI Ethernet interface

ICC : This alarm is generated if there is a communication problem between the Network management agent and the IDU microprocessor.

MGMT1 : This alarm is generated in case of a communication problem on MGMT1 serial port.

MGMT2 : This alarm is generated in case of a communication problem on MGMT2 serial port.

TSL2 : This alarm is generated in case of a communication problem between the two IDUs of the link (when the link is broken for instance).

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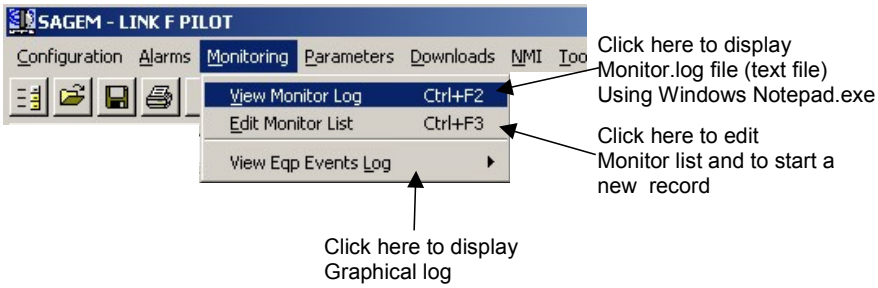
3.3.3 - Monitoring Menu

When clicking on the Monitoring menu, this screen appears :



Two Logs are available in SAGEM-LINK F equipments : the **monitor log**, which periodically record on the PC hard disk the status of selected events, and the **equipment events log** which store in the equipment RAM all events in case of status change.

Monitor log requires to have the PC connected to the SAGEM-LINK F during the whole measurement time, while equipment event log works without any PC connected.

3.3.3.1 - View Monitor Log

When Clicking on the View Monitor Log, SAGEM-LINK F Pilot starts the Windows Notepad to display Monitoring file.

This text file contains :

- Equipment information
- Monitoring parameters selected by the Edit Monitor Log control, with their status when starting monitoring.
- Link monitoring data

As this is a text file, it could be printed or exported to an other program.

Monitoring Messages

Each alarm name is followed by the alarm source: LOCAL for any local alarm and REMOTE for any remote alarm.
"Normal" means there is no alarm, while an "alarm" indication means an active alarm

Ex : "Transmit Freq 2 REMOTE Alarm" means there is an active transmit frequency alarm in the transmitter 2 (standby unit) of the far end equipment.

Alarm List

Transmit Power 1	: Transmit power alarm on transmitter 1 (main)
Transmit Power 2	: Transmit power alarm on transmitter 2 (Standby)
Transmit Freq 1	: Transmit frequency alarm on transmitter 1 (main)
Transmit Freq 2	: Transmit frequency alarm on transmitter 2 (standby)
Receive Level 1	: RSL alarm on receiver 1 (main)
Receive Level 2	: RSL alarm on receiver 2 (Standby)
PSU 1	: ODU Power Supply alarm 1 (main)
PSU 2	: ODU Power Supply alarm 2 (standby)
Cable 1	: ODU Cable alarm 1 (main)

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Cable 2	: ODU Cable alarm 2 (standby)
Modem Cable 1	: Modem or cable alarm on channel 1 (main)
Modem Cable 2	: Modem or cable alarm on channel 2 (Standby)
Modulation 1	: Modulator alarm on channel 1 (main)
Modulation 2	: Modulator alarm on channel 2 (standby)
Demodulation 1	: Demodulator alarm on channel 1 (main)
Demodulation 2	: Demodulator alarm on channel 2 (standby)
Link ID Code	: Link ID Code alarm
IDU	: IDU alarm
BER Warning	
BER Alarm	
Local Aux Input k	: Alarm on auxiliary input k on local equipment (k = 1 to 4)
Remote Aux Input n	: Alarm on auxiliary input n on remote equipment (n = 1 to 4)
Tributary i Fault	: Alarm on tributary i (i= 1 to 16)

Measurements List

RSL Channel 1 - xx dBm	: RSL on channel 1 (main) equal to - xx dBm
RSL Channel 2 - xx dBm	: RSL on channel 2 (standby) equal to - xx dBm
BER Channel 1 nE-m	: Bit error rate on channel 1 equal to $nx10^{-m}$
BER Channel 2 nE-m	: Bit error rate on channel 2 equal to $nx10^{-m}$

G.821 Quality Data

Period 1mn/15mn/30mn/60mn/24h	: G.821 data measuring period
G821 – ES xx	: number of errored seconds
G821 – IS xx	: number of unavailable seconds
G821 - SES xx	: number of seriously errored seconds
G821 - IP xx	: number of unavailable periods
G821 - ESR xx %	: rate of errored seconds over the measuring period (indicated above)
G821 - SESR xx %	: rate of seriously errored seconds over the measuring period (indicated above)
G821 - ISR xx %	: rate of unavailable seconds over the measuring period (indicated above)

G.826 Quality Data

Period 1mn/15mn/30mn/60mn/24h	: G.826 data measuring period
G826 - ES xx	: number of errored seconds
G826 - SES xx	: number of seriously errored seconds
G826 - BBE xx	: number of residual errored blocks, i.e. errored blocks coming outside the seriously errored seconds (SES)
G826 - ESR xx %	: rate of errored seconds over the measuring period (indicated above)
G826 - SESR xx %	: rate of seriously errored seconds over the measuring period (indicated above)
G826 - BBER xx %	: rate of residual errored blocks over the measuring period (indicated above)

Events that may occur during monitoring

LOCAL-REMOTE(TSL) Broken/Restored	: radio link broken/restored,
IDU-ODU(DCC) Broken/Restored	: Communication link between IDU and ODU broken/restored,
TRANSMISSION Channel 1/Channel 2	: channel 1/channel 2 radio transmitter switch,
RECEPTION Channel 1/Channel 2	: channel 1/channel 2 radio receiver switch,
The connection with SAGEM-LINK F Equipment is broken / restarted	: PC does not communicate with equipment any more

3.3.3.2 - Edit Monitor List

When Clicking on the Edit Monitor List menu, the following screen appears :

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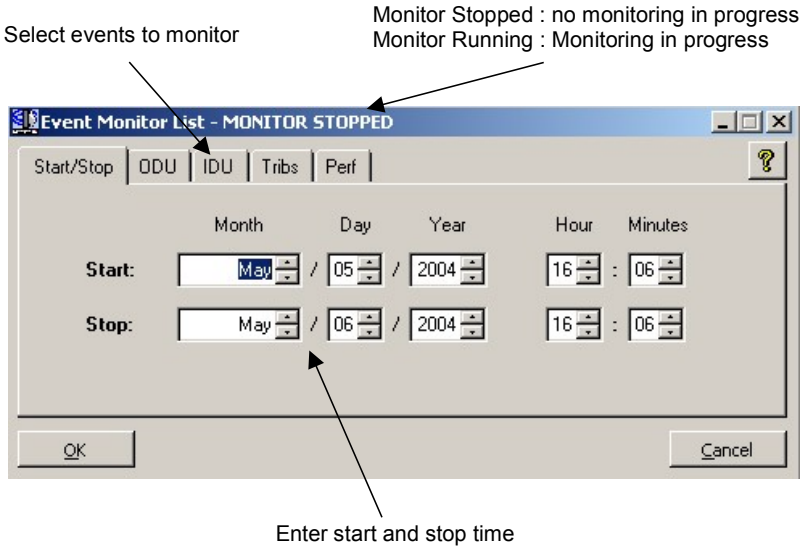
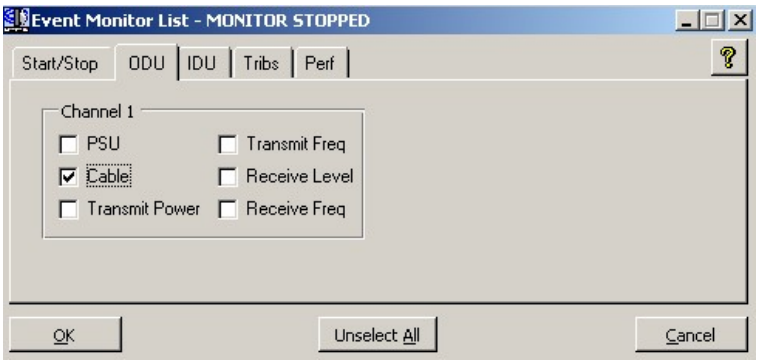
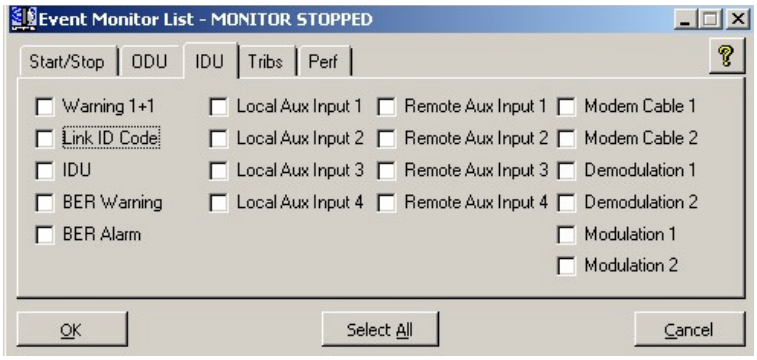


Enter monitoring start and stop date. This recording is only limited by the hard disk capacity. Be sure to have enough capacity on disk before starting a monitor log.

Then select the events you would like to monitor by clicking successively on the ODU, IDU, Tribs and Perf tabs.



ODU alarms



IDU alarms

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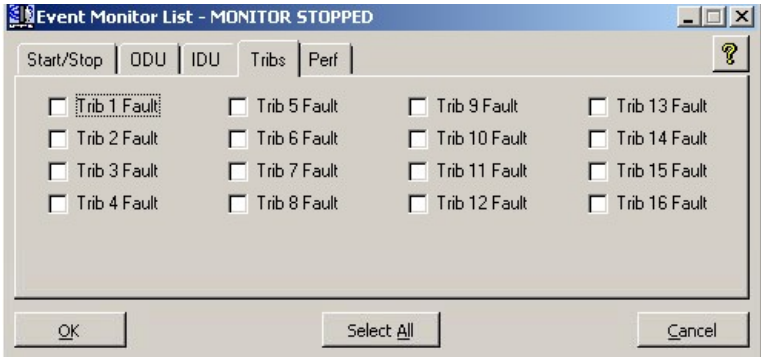
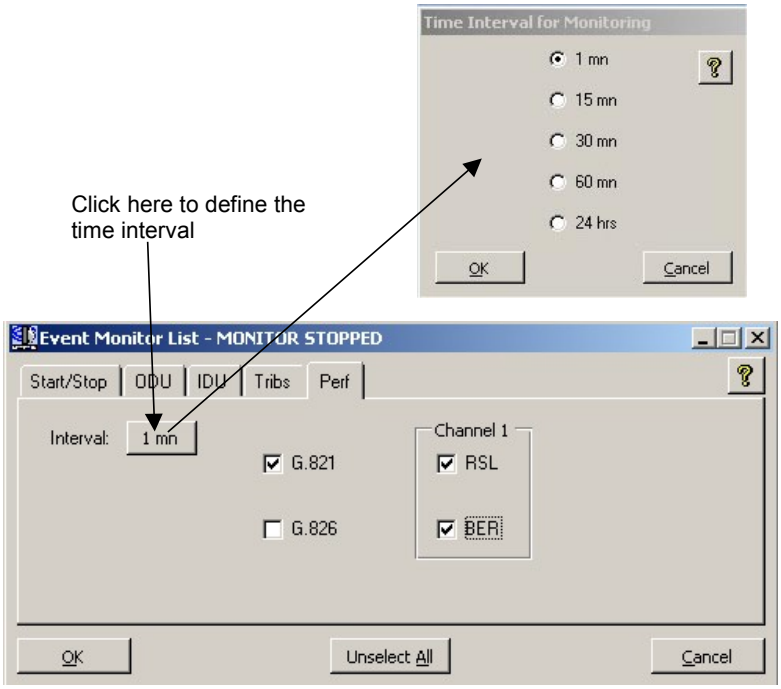


Tributary Alarms



Setting the time interval and the quality parameters

Once all parameters have been defined SAGEM LINK F Pilot will proceed to a new record. If a previous file monitor.log already exists, the Pilot will ask to save it or to delete it automatically by overwriting it.

3.3.3.3 - View Equipment Event Log

This log does not require to have the PC connected during measurement. All information is stored in the SAGEM-LINK F RAM. The information is available as long as SAGEM-LINK F is powered.

This feature does not work like monitor log : in order to limit the amount of information stored, only event changes are recorded.
Memory capacity allows to store the 1000 last events. This system works in complement with the monitor log as it is able to store the event when it occurs.

To access to this menu click on the menu "**Monitoring / View Eqp Log / Local** (or **Remote**)"

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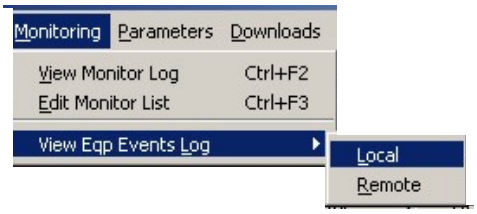
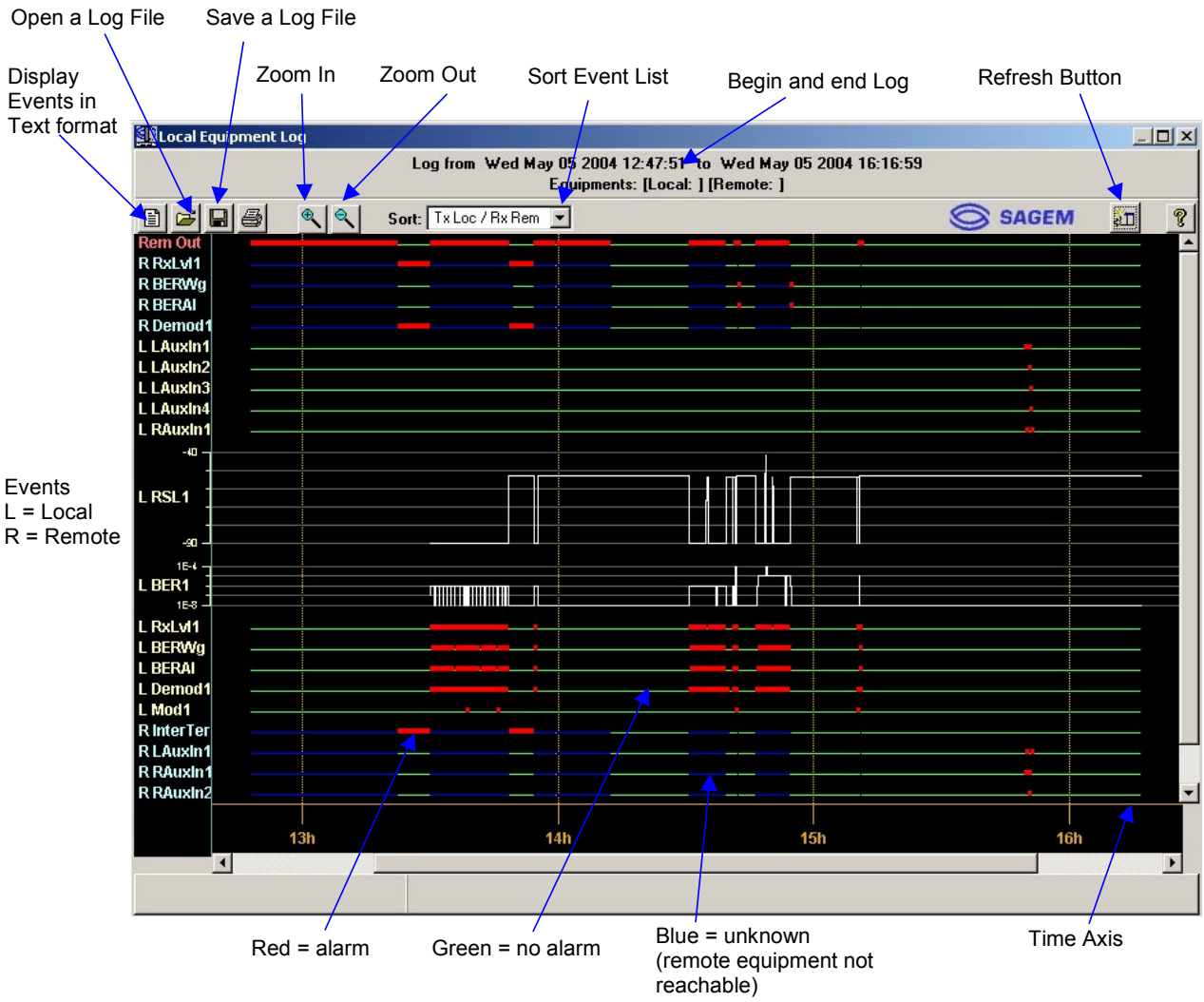


The following screen appears :



The graphical log allows to view major alarms for local and remote terminals, and also local and remote RSL and BER.

In order to facilitate graphic reading, if a specific alarm does not occur during the period, the alarm is not displayed in the screen. Only events which have changed are displayed.

When there is an alarm, the corresponding line becomes red. When the alarm status is unknown (remote terminal alarm with link broken), the color turns in blue. When the alarm is cleared, the line turns in green.

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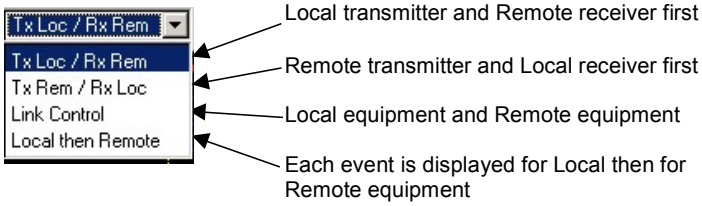
A Zoom in / Zoom out function is available with the mouse : to enlarge a specific area click on the Zoom in button and select an area with the mouse left button.
To return to the previous display, click on the Zoom Out button .

If you click on the sort list, the following menu appears :


Tx Loc / Rx Rem
Tx Loc / Rx Rem
Tx Rem / Rx Loc
Link Control
Local then Remote
Local transmitter and Remote receiver first
Remote transmitter and Local receiver first
Local equipment and Remote equipment
Each event is displayed for Local then for Remote equipment

This menu allows the user to sort the list of the events in 4 different ways.

Log files can be saved on the hard disk by clicking on the save button , or opened by clicking on the open button .

Log files can also be saved as text files by clicking on the text button .

The list of events that may be displayed is as follows. The prefix **L** or **R** before the event name means **L**ocal or **R**emote.
The suffix **1** or **2** means Main or Standby terminal (1+1 systems).

Event Name	Event Description
Com Fail	Pilot and local equipment do not communicate
Rem Out	Link broken
Tx Pwr	Transmit Power Alarm
Tx Freq	Transmit Frequency Alarm
Rx Freq	Receive Frequency Alarm
Rx Levl	Receive Level Alarm
LinkID	Link ID Alarm
IDU	IDU Alarm
LauxIn i	Dry Loop Input #i (i = 1 to 4)
RauxIn i	Dry Loop Output #i (i = 1 to 4)
BER Wg	BER Warning
BER Al	BER Alarm
Mod	Modulator Alarm
Demod	Demodulator Alarm
Cable	Cable Alarm

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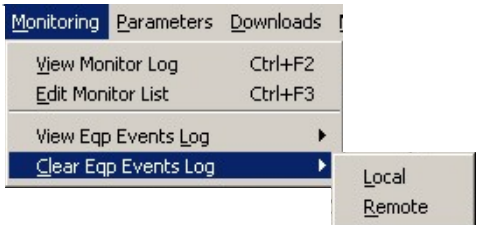
Trib n	Tributary n Fault (n = 1 to 16)

Note : There is no internal clock in Sagem-Link F equipment. The absolute time is given by the PC which is connected.

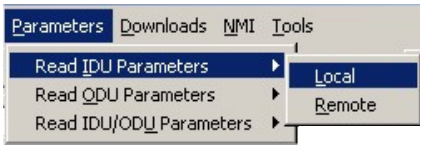
3.3.3.4 - Clear Equipment Event Log

To begin a new measurement on local or remote equipment click on the menu Clear Eqp Events Log / Local or Remote :



3.3.4 - Parameters Menu

When clicking on the Parameters menu, this screen appears :



The parameters section gives an information on the hardware and software versions of the equipment, and on the current parameters.
These informations are available for the local and the remote equipment.

3.3.4.1 - Read IDU Parameters

When clicking on this menu, the following screen appears :

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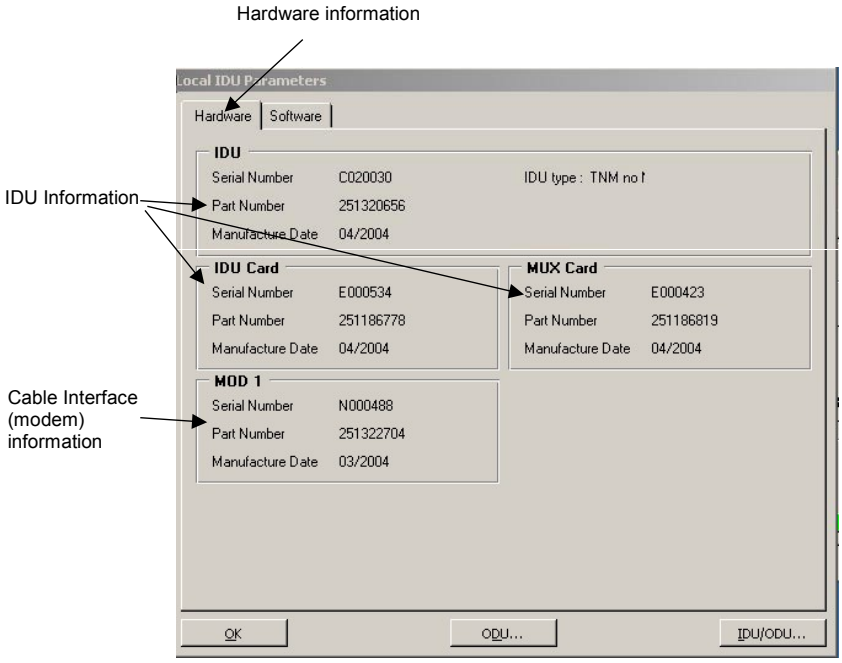
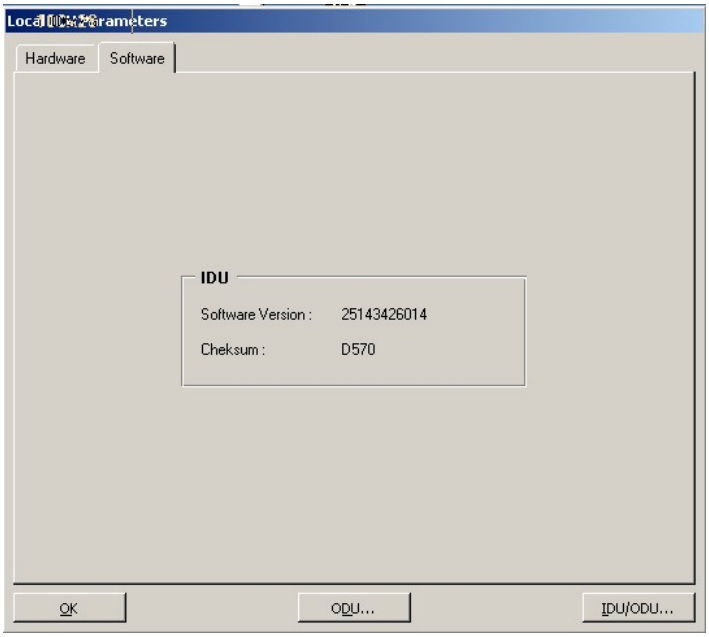


This screen give hardware information regarding IDU composition (IDU Card, Mux Card) and Cable Interface (modem) module.

When clicking on the Software Tab, the current IDU software version is displayed :



3.3.4.2 - Read ODU Parameters

When clicking on this menu, the following screen appears :

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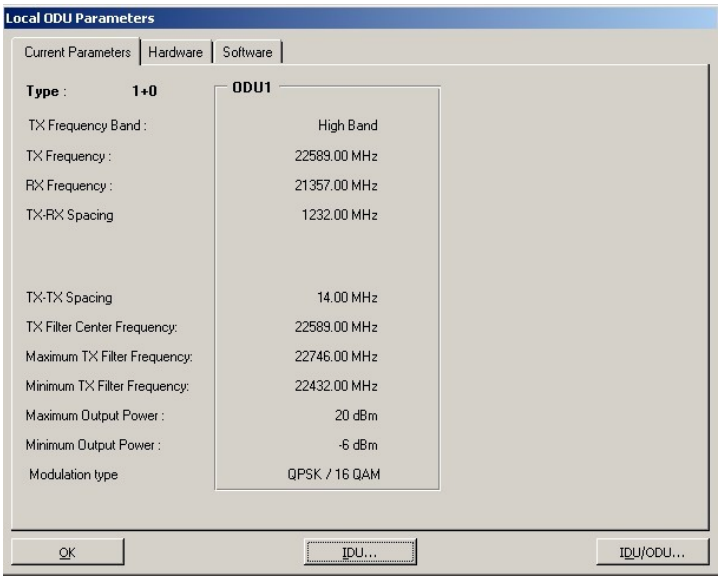
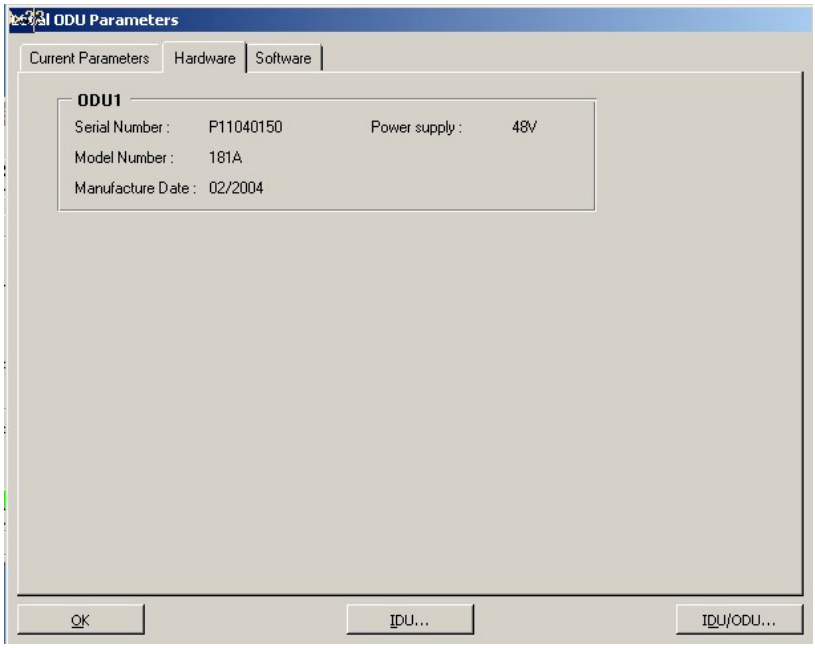


This screen contains current radio parameters, and also ODU frequency and power ranges. Use Hardware and Software tabs to know hardware and software versions.



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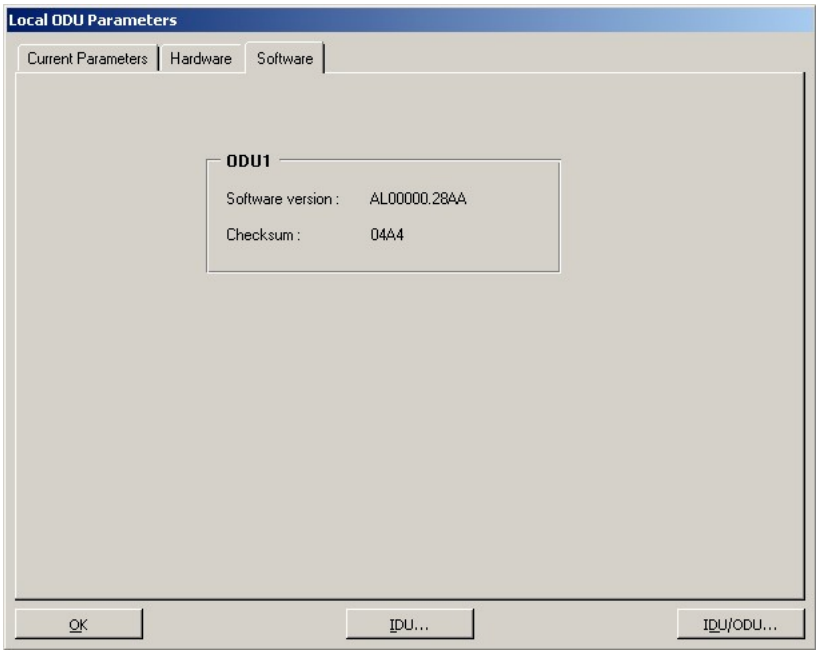
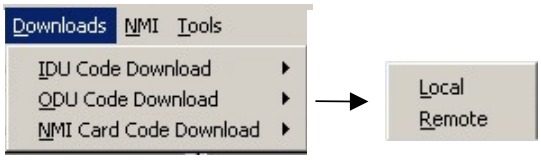

Local ODU Parameters
Current Parameters
Hardware
Software
ODU1
Software version : AL00000.28AA
Checksum : 04A4
OK
IDU...
IDU/ODU...

3.3.5 - Downloads Menu

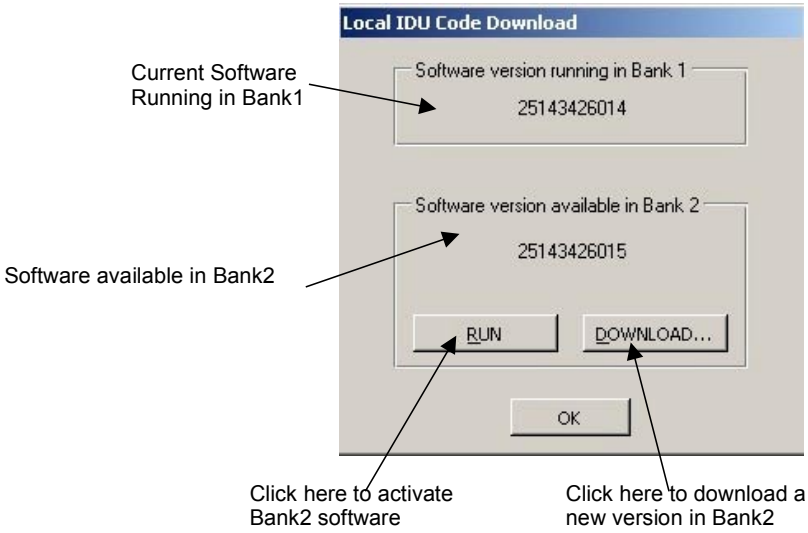
IDU software, ODU software and NMI (SNMP agent) software are downloadable. These operations are only possible when logged as super user.

Click on the Download Menu and select IDU, ODU or NMI (Local or Remote) :



3.3.5.1 - IDU Code Download

The IDU download screen is given below :



From this screen, it is possible to activate the version stored in bank 2, or to replace bank2 software by a new one, by clicking on the download button.

When downloading is in progress, an indicator is displayed to check operation is correctly processed.

In the event of incompatibility between the downloading software and the equipment, the following message appears: "**Loading error**".

Note : when a new software version is activated, the system reset automatically the IDU.

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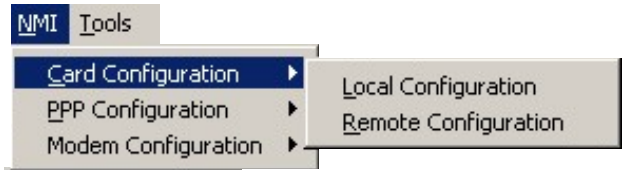
3.3.6 - NMI Menu

This menu is used only when the equipment is part of a network managed by a SNMP manager. With this menu, it is possible to configure the network management function, and to download a new NMI software.

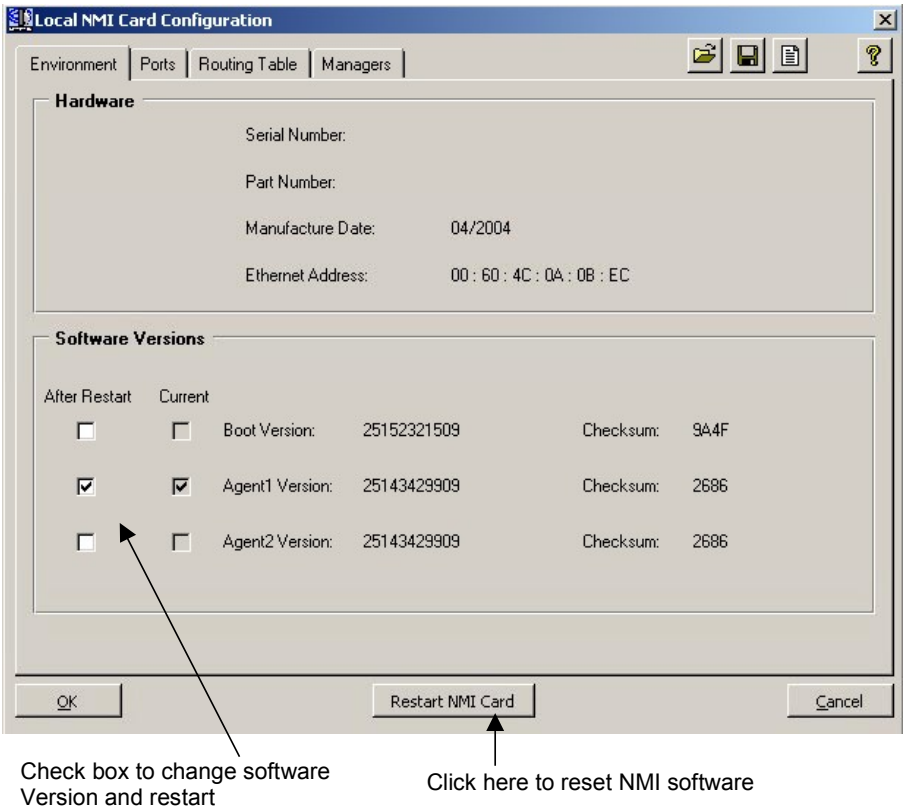
When clicking on the NMI menu, the following windows appears :



3.3.6.1 - NMI Card Configuration Menu

NMI Card Configuration – Environment Tab

Click on the Card Configuration /local or remote configuration menu. The following screen appears :



Available NMI Boot and Agent versions are indicated in this first screen, with the specific Ethernet address.

From this screen it is possible to reset NMI software and to activate the second agent version if necessary.

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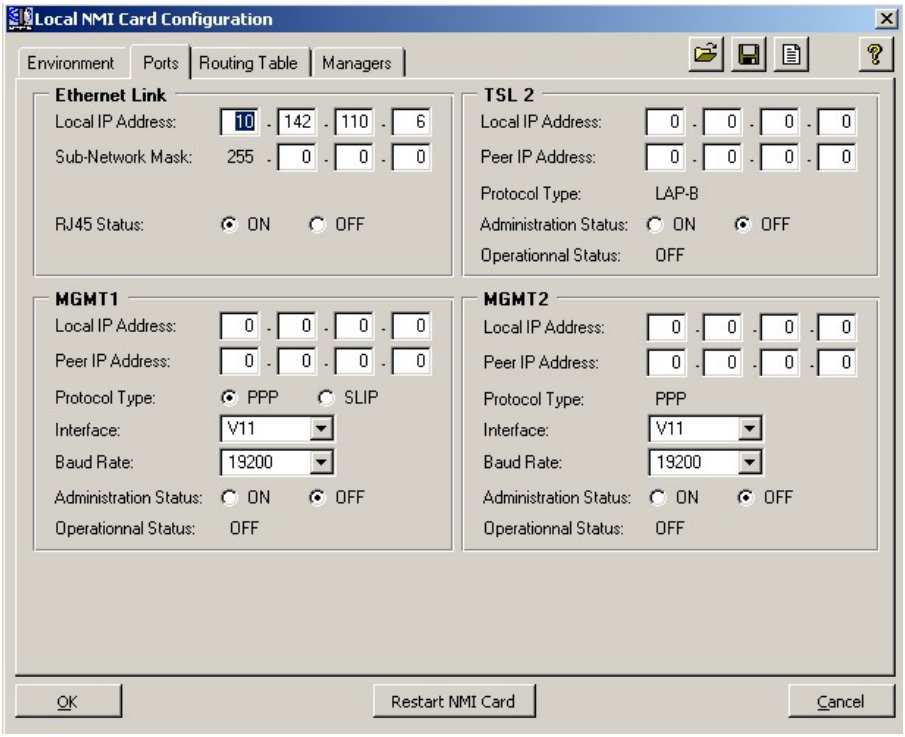
NMI Card Configuration – Ports Tab

Click on the "Ports" tab : The following screen appears :


Local NMI Card Configuration
Environment
Ports
Routing Table
Managers
Ethernet Link
Local IP Address: 10 . 142 . 110 . 6
Sub-Network Mask: 255 . 0 . 0 . 0
RJ45 Status: ON OFF
TSL 2
Local IP Address: 0 . 0 . 0 . 0
Peer IP Address: 0 . 0 . 0 . 0
Protocol Type: LAP-B
Administration Status: ON OFF
Operationnal Status: OFF
MGMT1
Local IP Address: 0 . 0 . 0 . 0
Peer IP Address: 0 . 0 . 0 . 0
Protocol Type: PPP SLIP
Interface: V11
Baud Rate: 19200
Administration Status: ON OFF
Operationnal Status: OFF
MGMT2
Local IP Address: 0 . 0 . 0 . 0
Peer IP Address: 0 . 0 . 0 . 0
Protocol Type: PPP
Interface: V11
Baud Rate: 19200
Administration Status: ON OFF
Operationnal Status: OFF
OK
Restart NMI Card
Cancel

The screen is divided in four sections :

Ethernet Link section : enter the IP address and submask of the Ethernet link and check the case "ON" to activate the port.

TSL2 section : TSL2 corresponds to a SAGEM-LINK F data channel dedicated to carry management data between local and remote NMI.

TSL2 is a serial link with a local IP address on the local terminal and a Peer IP address on the remote end terminal. If TSL2 link is involved for this equipment, it is necessary to enter both IP addresses, and to check the "ON" case for Administration status.

When TSL2 port is not used (i.e. there is no management specific link between the two terminals of the link) check the "OFF" case

Operational status : this information gives an information on the TSL2 link status between local NMI interface and remote NMI interface.

MGMT1 and MGMT2 sections : MGMT1 and MGMT2 corresponds to two serial ports used to connect two equipments or to connect the NMI to an external equipment (modem).

When these ports are not used, click on the "OFF" case on the corresponding administration status line.

If they are used, then enter port IP address, subnet mask and choose interface and communication protocol (default : PPP).

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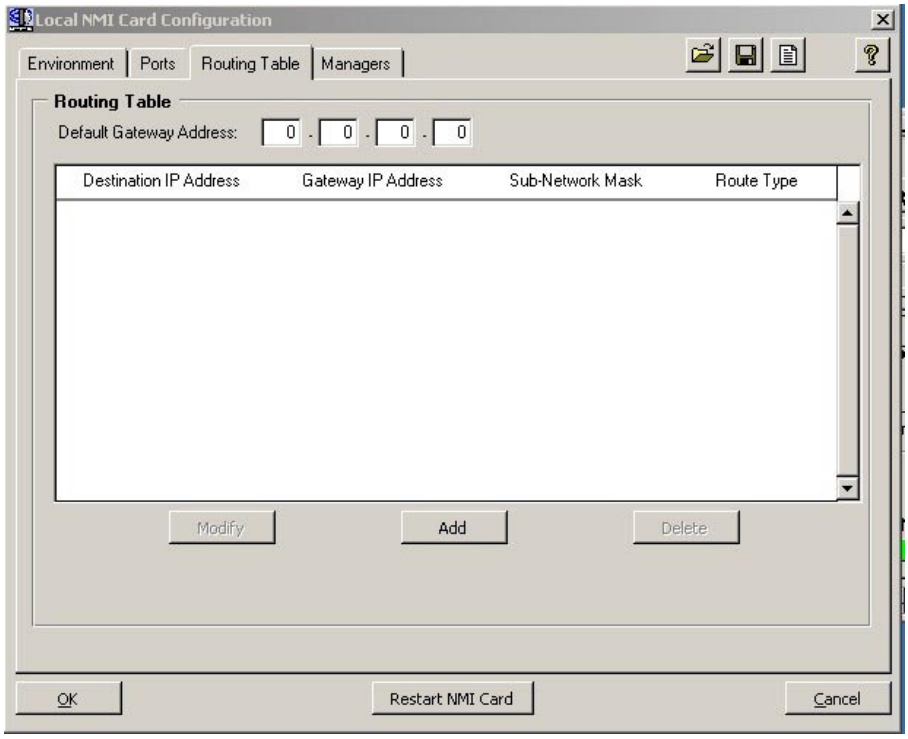
NMI Card Configuration – Routing Table Tab

Click on the "Routing Table" tab : The following screen appears :



Enter routing table addresses :

Enter Default Gateway Address, Destination IP Address, Sub-Network Mask and Route Type.

For Route Type there are three possibilities : Host, Network or Subnet.

Note : The maximum number of routes is 20.

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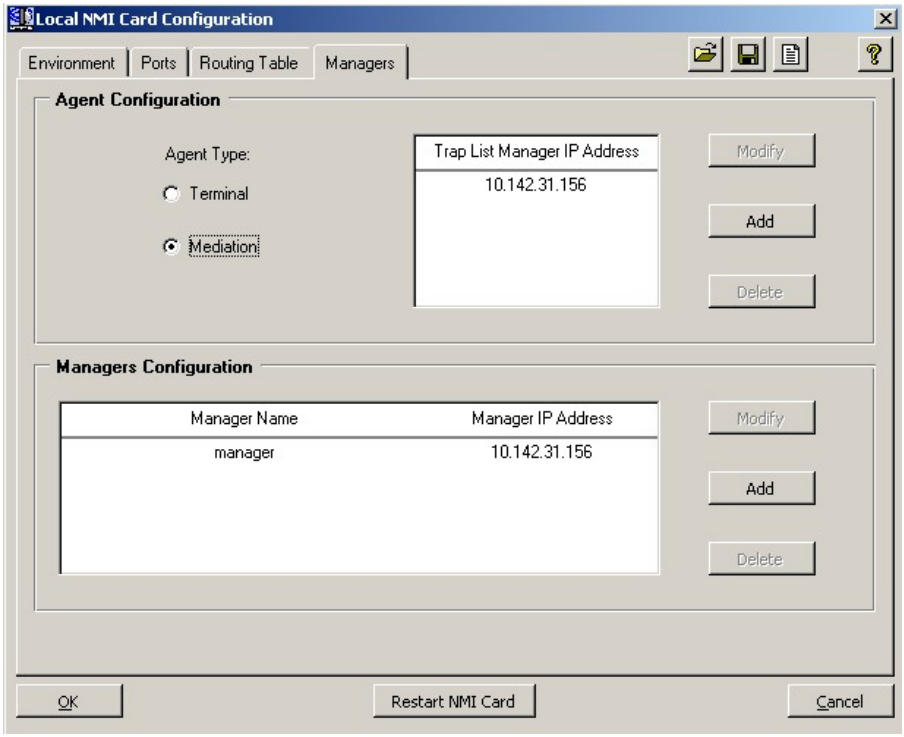
NMI Card Configuration – Manager Tab

Click on the "Manager" tab : The following windows appears. This screen contains two sections :

Agent configuration and Managers configuration.



Agent Configuration :

Select for **Agent Type** "Terminal" or "Mediation".

When the agent type is in terminal mode, the NMI interface sends to the PC local and remote equipment traps.

When the agent type is in mediation mode, the NMI interface sends to the PC only local equipment traps.

Trap List Manager IP Address : enter, modify or delete the PC IP address which manages equipment traps.

Manager Configuration

Manager Name : enter a name for the PC used as a manager

Manager IP Address : enter manager IP address

Note : Le maximum number of managers used in a network is 5

3.3.6.2 - PPP Configuration Menu

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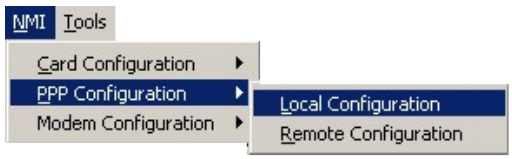
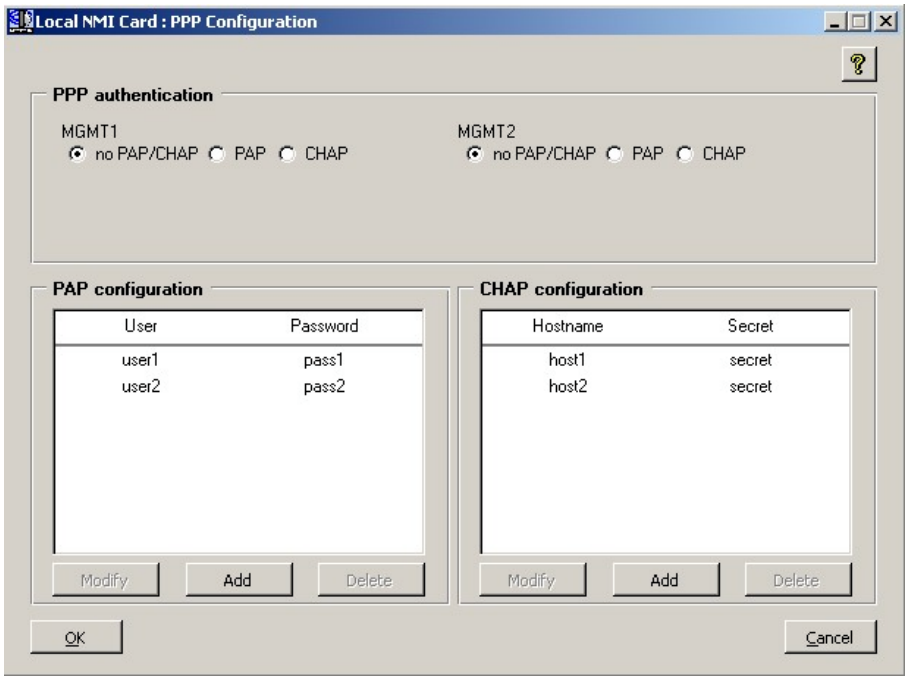
Click on the PPP Configuration /local or remote menu.



The following screen appears :



This menu allows to configure the MGMT1 and MGMT2 declared PPP links. PAP and CHAP protocols cannot be used at the same time.

When a PAP or CHAP authentication request is activated on a port the NMI requests the host to identify itself. If this ID is not present in the list the communication is refused by the NMI and it is not established.

If no PAP or CHAP authentication request from the NMI is active, the NMI responds to authentication request from the remote equipment.

MGMT1 and MGMT2 PAP or CHAP are independent.

PAP configuration : enter users and corresponding passwords (1 to 18 characters each).

CHAP configuration : enter host name and secret linked to this name (1 to 18 characters each).

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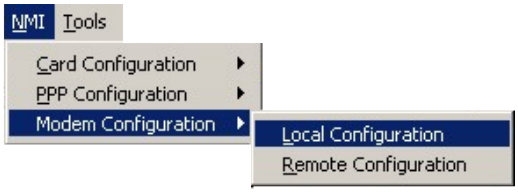
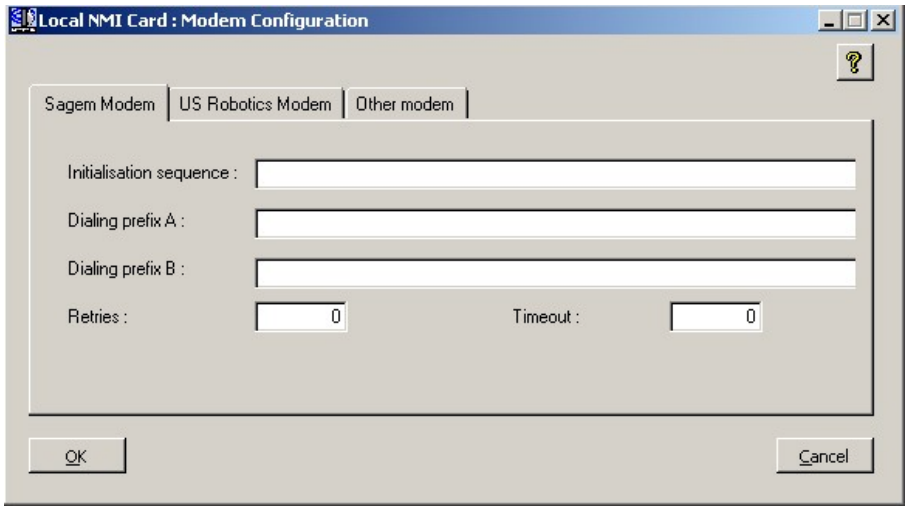
3.3.6.3 - Modem Configuration Menu

If a modem is to be connected on the **MGMT1 port**, click on the Modem Configuration /local or remote menu.



The following screen appears :



Select the tab corresponding to your modem.

Initialization sequence : ATE0 to remove modem echo, then ATQ1 for the modem response codes, then the command line.

Dialing prefix A : enter phone number used for calling

Dialing prefix B : enter other phone number is case of unavailability of "A"

Retries : Number of failed call attempts

Timeout : Line disconnection time in minutes (when no call message is detected)

Note : Before dialing the NMI can send an AT command in order to block automatic disconnection in case of inactivity. This command may be different according to the modem type.

ATS34=0 for a SAGEM modem

ATS19=0 for a US Robotics modem

No command for the other modems. In this case the initialization sequence must be customized in order to :

- Deactivate automatic disconnection in case of inactivity
- Save the configuration

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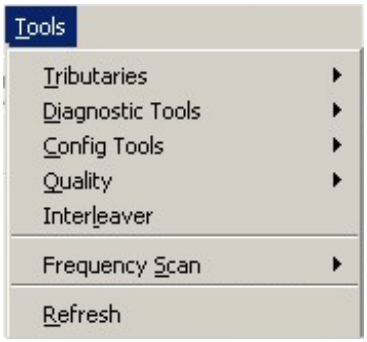
3.3.7 - Tools Menu

This menu provides some tools regarding installation, diagnostics, and maintenance operations.



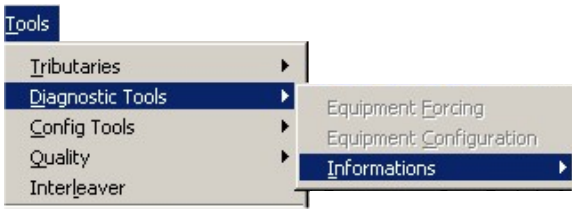
3.3.7.1 - Tributaries

This menu allows the user to make tributary or multiplexer loopbacks and to configure tributary interfaces. See **section 3.2.4** of this chapter for complete description.

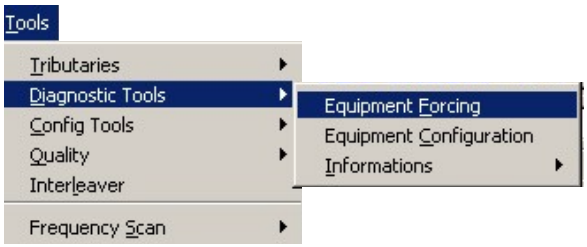
3.3.7.2 - Diagnostic Tools

This menu includes 1+1 tools like static phase adjust, or manual switches for transmitters and receivers.
In addition, it includes a memo used to store information in the equipment.

When clicking on Diagnostic tools menu, for a 1+0 link, the following screen appears :



Note : For a 1+1 system, Equipment Forcing and Equipment Configuration menu are active.



Equipment Forcing (1+1 only)
This menu allows to control transmit and receive 1+1 switches manually. When clicking on Equipment Forcing menu, the following windows appears :

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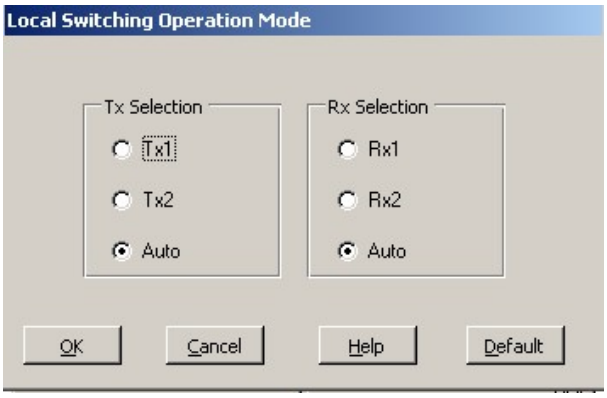
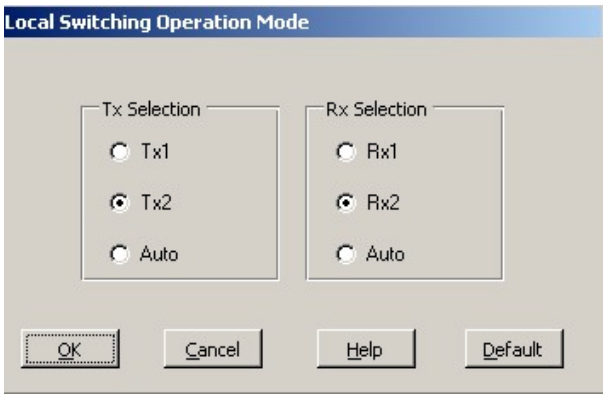


Transmit and Receive switches are independent one from each other. A system can work with transmitter from main ODU (Tx1) and with receiver from standby ODU (Rx2).

In normal operation, transmitter and receiver switches are in "Auto" position.

To force one transmitter or one receiver in manual position, click on the case close to the corresponding unit. In the example below, standby transmitter and receiver have been selected.



The system is now in maintenance mode. The yellow LED in IDU front panel flashes and a red maintenance indication is displayed on the main Pilot screen status bar.

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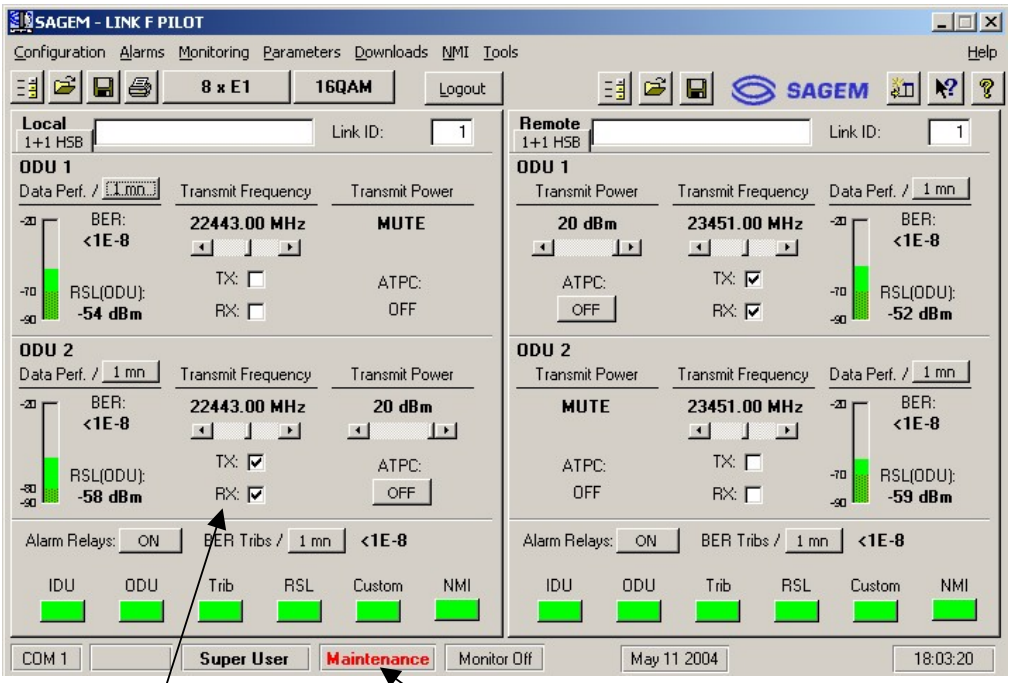
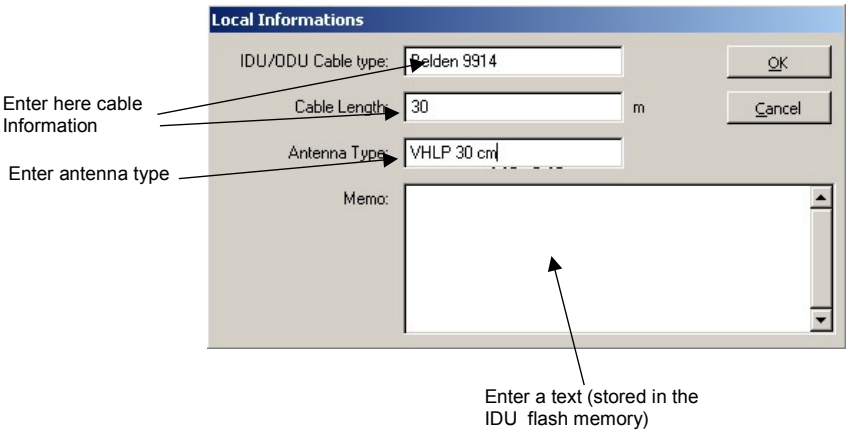


Equipment Configuration (1+1 only)
Refer to section 3.2.4.9.

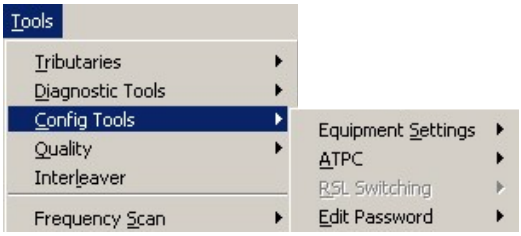
Information (local or remote)
When clicking on this menu the following window appears :



Enter here all information which should be useful for link management (this information can be read from the network management).

3.3.7.3 - Config Tools

When clicking on the config Tools menu, the following windows appears :



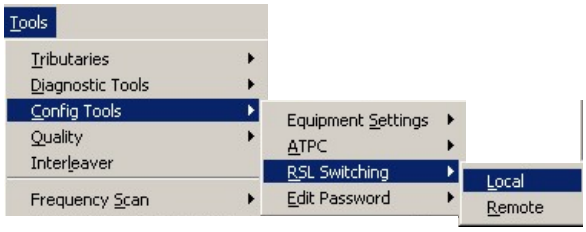
Equipment Settings
Refer to section 3.2.4.6.

ATPC
Refer to section 3.2.4.7.

RSL Switching
This menu is only available for **1+1 space diversity or for 1+1 frequency diversity** configurations.

In 1+1 hot standby mode, the RSL switching criteria is not taken in account by the receive switch.

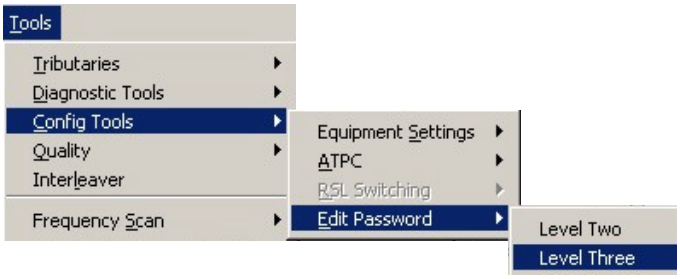
When this menu is selected then the following windows appears :



Click on local or Remote and enter the RSL Switching threshold :

In diversity mode, if the receive level of both receivers are greater than this threshold, then this criteria is not taken in account by the receive switch.
If the RSL of one of the receivers is below this threshold, then the system selects the receiver with the best receive level.

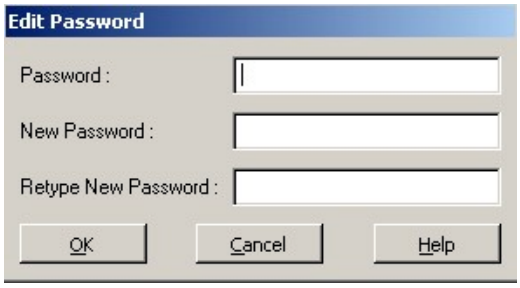
Edit Password
This menu allows to modify default passwords. When clicking on this menu, the following windows appears :



Level Two corresponds to the **user** mode password (default "**1234**"), while level three refers to the **super user** mode password (default "**2345**").

To change a password, it is necessary to be logged at a level equal or higher to the password to be changed.

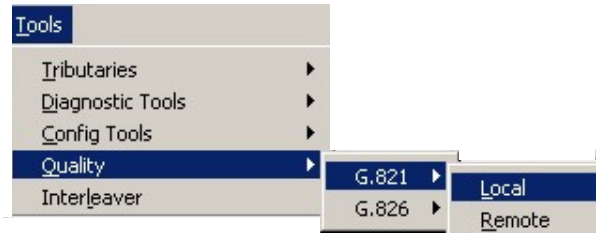
Click on the level you would like to change, the following windows appears :



Enter first the current password, then the new password (twice) and confirm.

3.3.7.4 - Quality

When clicking on the Quality menu, the following windows appears :



Select G821 or G826, and local or Remote.

By clicking on the Edit Period button, you can set the measurement duration to 1 minute up to 24 hours.

The refresh button resets all counters.

G821 Report

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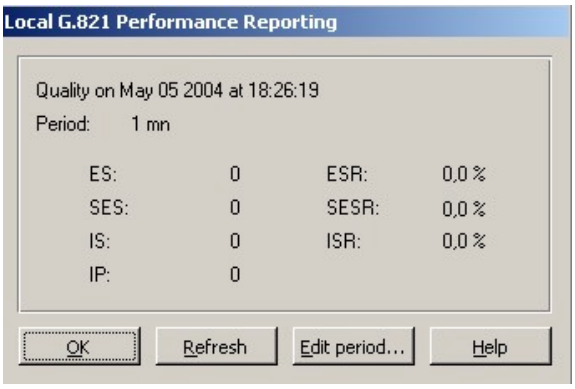
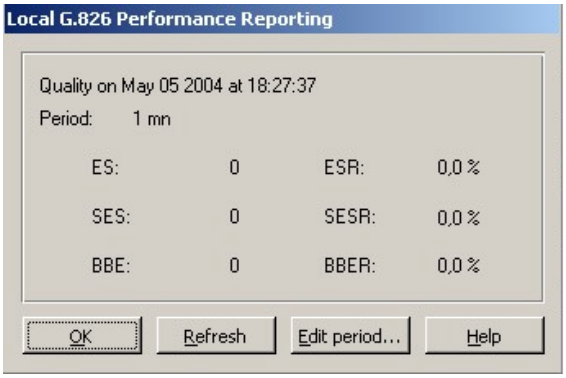


Quality upon G821

With :

ES	=	number of errored seconds
IS	=	number of unavailable seconds
SE	=	number of seriously errored seconds
IP	=	number of unavailable periods
ESR	=	rate of errored seconds over the measuring period
SESR	=	rate of seriously errored seconds over the measuring period
ISR	=	rate of unavailable seconds over the measuring period

G826 Report



With

ES	=	number of errored seconds
IS	=	number of unavailable seconds
BBE	=	number of residual errored blocks, i.e. errored blocks coming outside the seriously errored seconds (SES)
ESR	=	rate of errored seconds over the measuring period
SESR	=	rate of seriously errored seconds over the measuring period
BBER	=	rate of residual errored blocks over the measuring period

3.3.7.5 - Interleaver

Refer to section 3.2.4.8.

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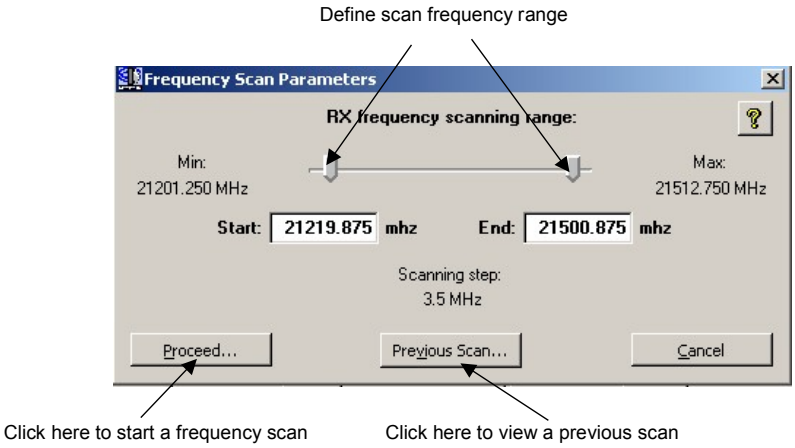
3.3.7.6 – Frequency Scan

Frequency scan is a special function of SAGEM-LINK F Pilot used to measure receive spectrum around receive frequency, in order to identify radio interferers which could degrade the link sensitivity. The results are displayed graphically and are stored in the IDU flash memory for further consultation.

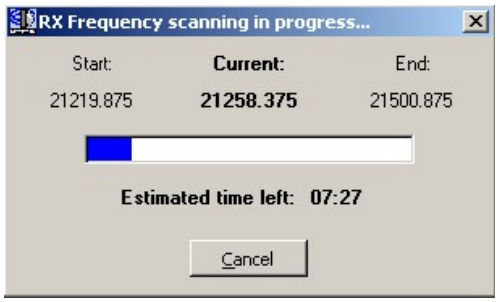
Frequency scan is to be performed separately on each terminal. The user defines maximum and minimum frequencies to scan. The local transmitter is muted, while the system measure Receive Signal Levels frequency per frequency.

Note : To proceed to a frequency scan, it is necessary firs to change the current capacity and modulation to a **2 E1/QPSK** mode.

When clicking on the frequency scan menu this windows appears :



Define the scan frequency range by moving the cursors, start by clicking on the Proceed button. The frequency scan starts and the following screen is displayed :



Once the frequency scan is complete, the result is displayed graphically. Frequency step and resolution bandwidth filter are 3.5 MHz. The result is automatically stored in the IDU.

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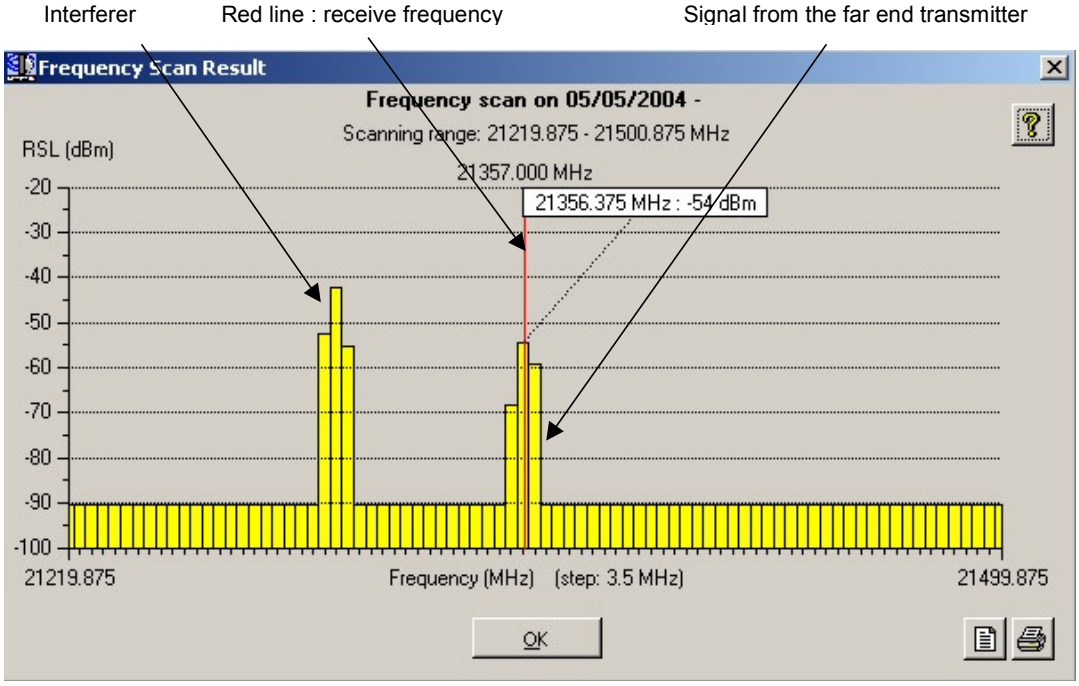


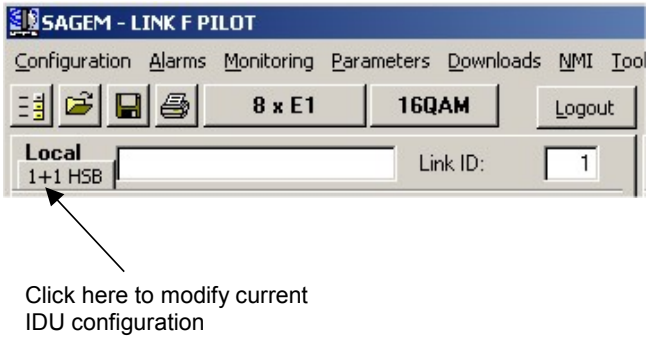
3.3.8 – Changing an IDU Configuration

SAGEM-LINK F IDU can be used for 1+0 unprotected systems or for 1+1 protected system without any hardware change.
There are four possible configurations : 1+0, 1+1 HSB (Hot Standby), 1+1 SD (Space diversity) and 1+1 FD (Frequency Diversity).

SAGEM-LINK F Pilot allows to modify the current configuration to a new one. This change is made without any ODU connected.

Procedure :

- Switch off the IDU
- Remove any ODU connection
- insert one cable interface module for a 1+0 equipment or two cable interface modules for a 1+1 system
- Switch on the IDU without any ODU connected and run the Sagem-Link F Pilot software in super user mode
- Click on the button indicating IDU configuration



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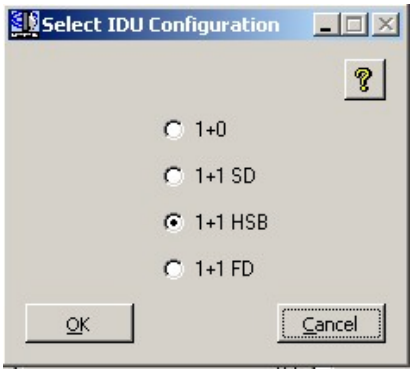
The following windows appears :



- Click on the case corresponding to the new configuration and validate
- Switch off the IDU and connect ODU cables
- Switch on the IDU

.

Note : When changing system configuration on a link, it is important to have always the same configuration on both ends of the link. Do not switch on the equipment until the far end has been modified accordingly.

A 1+1 configuration on one end and a 1+0 configuration on the other end will cause a software issue.

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Chapter 4

Troubleshooting

4.1 - Overview

This chapter provides information on interpreting LED indicators, SAGEM-LINK F Pilot screens and gives procedures for unit replacement.

This chapter contains :

- Visual Inspection
- Alarms and Status Indication LED Description
- Troubleshooting Steps
- SAGEM-LINK F Pilot Alarm menus
- Typical Pilot screens
- Replacing an ODU
- Replacing a cable interface module
- Replacing an IDU

Required test equipment

- Laptop Computer with a serial interface
- Sagem Link F Pilot software
- 2 Mbit/s Bit Error Rate Analyzer
- Digital voltmeter

4.2 – Visual Inspection

Before beginning any specific action on the SAGEM-LINK F radio it is important to proceed to a visual inspection and to note any discrepancy :

Visual Inspection	Look for	Actions
IDU to ODU Coaxial Cable	Cracks, short circuits, moisture	Clean or Repair
IDU and ODU	Dust, Lightning Strike damages	Clean or replace
Alarms (front panel and Pilot screen)	All Green	If red indicator, perform troubleshooting
Receive Signal Level (from Pilot screen)	Nominal value (installation data)	Re align antenna, check remote terminal transmit power
DC Voltage Input	Within specified range	Replace power supply
Antenna mounting	Tight mount	Adjust

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4.3 – Troubleshooting Steps

The goal is to make a precise diagnostic of the problem, in order to determine the faulty unit, or to apply corrective actions to avoid the problem to reappear.

4.3.1 – Define the symptom

This is generally made by the field technician : common symptoms are " the link is broken", there are excessive transmission errors", "there are alarms", …
These symptoms may be permanent (failure) or intermittent. Using monitoring graphical log may be very useful when searching transient phenomenas (see chapter 3 section 3.3.3.3).

4.3.2 – Isolate the problem

Once the symptom has been defined, the faulty unit can be isolated using LED Indicators and SAGEM LINK F Pilot informations.
SAGEM-LINK F replacement units are the ODU, the IDU or the cable interface module. A 1+0 link is composed of 6 units. The goal of this step is to determine what is the most probable unit to replace.
In some cases, the problem may be generated by the remote terminal, by external equipments (power supply, bad interface signal levels…) or by the external environment (path obstruction, radio interferers, severe climatic conditions,…).

4.3.3 – Fix the problem

Once the problem has been isolated, it is important to understand the cause of the problem and to apply corrective actions to avoid the problem to reappear.

Some typical radio links problems are presented in the following sections in this chapter.

4.4 – Alarms and Status Indication LED

The IDU Front panel, and cable interface module(s) have the following LEDs :

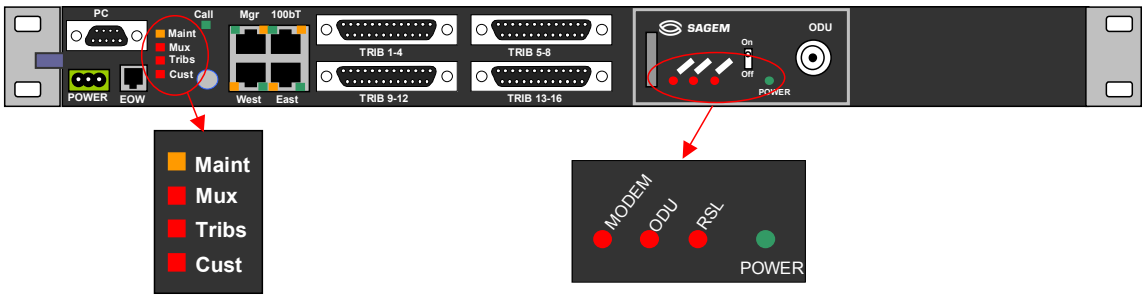

Figure 4.1 – LEDs Alarms and Status Indication LEDs

IDU LEDs

- The orange "**Maint**" status LED flashes during a maintenance operation, like a tributary loopback or a manual control of the protection switches.
- The "**Mux**" alarm LED lights red, when there is multiplexer or a demultiplexer failure, or when receive data is not recovered (link broken)
- The "**Tribs**" alarm LED lights red, if there is a lack of input signal on a tributary configured as normal, or if there is an input signal on a tributary configured as inverted.
- The "**Cust**" alarm LED lights red, if there is a custom alarm (see chapter 3 section 3.3.2.1 for description).

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Cable Interface Module LEDs

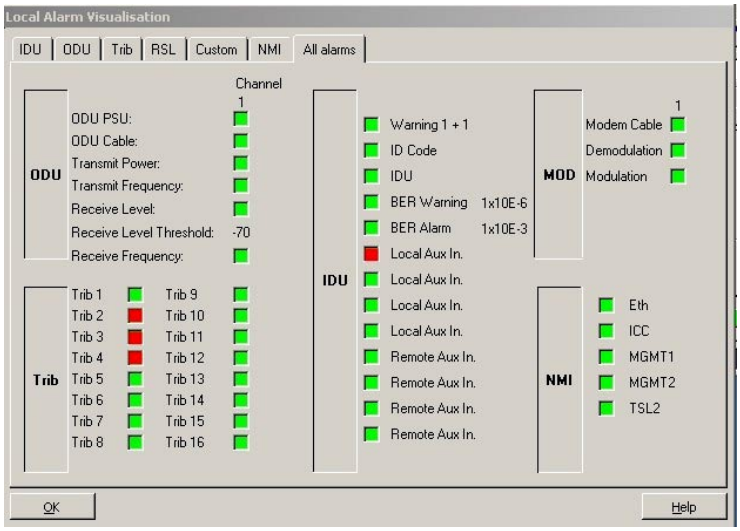
- The "**Modem"** alarm LED lights red, when there is a cable interface module alarm like a cable fault, a modulator fault, a demodulator fault (receive data not recovered) or a power supply fault.
- The "**RSL**" alarm LED lights red, when the current receive signal level is below the RSL threshold, or when there is a BER degradation (BER alarm, or BER warning active). This alarm corresponds in most cases to a propagation or to an interferer problem
- The "**ODU**" alarm LED lights red, if there is an ODU alarm, or if there is an ODU not connected.
- The "**Power**" Status indication lights green, when Cable Interface Module is powered.

4.5 - SAGEM-LINK F Pilot Alarm Menus

SAGEM-LINK F Pilot software provides information on link status and alarm information. These informations are available in the main screen and in the alarm menu. Refer to chapter 3 for Pilot description

4.5.1 – Alarms Screen

Click on the alarm menu (refer to chapter 3 section 3.3.2 for description). Click on the "**All alarms**" tab to have a complete view of all available alarms (local or remote terminal). All active alarms are indicated with a red color.



The description of all available SAGEM-LINK F alarms is given below :

ODU Alarms	Description	Corrective action
ODU PSU	Power Supply Alarm returned from the ODU. This alarm is active when there is a default in the ODU power supply, or when the DC input voltage at ODU	Check DC Power supply, and cable losses. If the cable and DC power are good, replace the ODU

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	input is too low	
ODU Cable	ODU Cable Alarm is generated by the ODU in case of an transmit IF input level below the limit	Check IDU to ODU cable losses. If the cable is good, replace Cable Interface module, or the ODU.
Transmit Power	A transmit Power alarm is generated by the ODU in case of a transmitter AGC loop fault, or in case of a transmitter mute set by the operator (in 1+1 system when both transmitters are in mute position).	Replace the ODU
Transmit Frequency	This alarm is generated in case of IF or RF receive synthesizer faults. When this alarm is active, transmitter is also in mute position.	Replace the ODU
Receive Frequency	This alarm is generated in case of IF or RF receive synthesizer faults.	Replace the ODU
Receive Level	This alarm is generated when receive signal level is below the receive threshold (default -70 dBm). This alarm could be generated in case of a faulty remote transmitter, a propagation problem, a bad antenna alignment, or a faulty receiver..	Use other indications like remote receiver receive level, and remote terminal alarms to make a diagnostic

Tributary Alarms	**Description**	**Corrective action**
Trib Alarm	a tributary alarm is generated when there is a lack of input signal for a tributary configured as "normal" (N), or when there is a input signal for a tributary configured as "inverted" (I).	check the corresponding cable, and verify that external equipment is properly connected. (see chapter 3 for more details).

IDU Alarms	**Description**	**Corrective action**
Warning 1+1	A 1+1 warning is generated when main or standby units (ODU or cable interface module) is not available (alarm or absent). The system continues to work, but it is not protected	Replace faulty units (cable interface module or ODU)
ID Code	When local and remote ID Code do not match, there is an ID Code alarm generated, and there is a AIS emission on the receive data from the remote terminal.	First verify that remote terminal ID code corresponds to local terminal. If the alarm is maintained, it means there is an other link at the same frequency which causes an interference. It should be necessary to change transmit frequency or polarization to avoid such interferences
IDU	This alarm is active in case of an IDU fault, or in case of problem to recover receive data (same as Mux LED in front panel).	Verify other parameters like receive signal level, remote terminal alarms, path obstructions, radio interferers.
BER Warning	This warning is generated when BER is greater than the BER warning threshold (default 10^{-6}).	Same as BER alarm
BER Alarm	This alarm is generated when BER is greater than the BER alarm threshold (default 10^{-3}). A BER alarm can be generated by a poor receive level, or by an other problem like a remote modulator fault or a radio interferer	Many possible causes : propagation problem (check RSL), Interferer presence (make a frequency scan), Power supply problem, remote transmitter problem, receiver problem, demodulator problem.
Local Aux In Alarms	These four alarms represent local terminal input dry loop status	External alarms
Remote Aux In Alarms	These four alarms represent remote terminal input dry loop status	External alarms

Cable Interface Alarms	**Description**	**Corrective action**
Modem Cable	This alarm is generated in case of a modem fault, or	Check first IDU to ODU cable, RSL and

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	a IDU to ODU cable fault, or in case of lack of ODU (IDU to ODU communication link not operating).	replace modem cable or ODU. A modem cable may be generated by many causes (see BER alarm)
Demodulation	This alarm is generated if there is a demodulator fault or if received data is not recovered	Same as modem cable
Modulation	This alarm is generated if there is modulator fault. When a modulation alarm occurs, the transmitter is muted	Replace the Cable Interface Module

NMI Alarms	Description	Corrective action
Eth	This alarm is generated in case of a hardware failure regarding NMI Ethernet interface	Check Ethernet cable and configuration
ICC	This alarm is generated if there is a communication problem between the Network management agent and the IDU microprocessor.	Replace the IDU
MGMT1 or 2	This alarm is generated in case of a communication problem on MGMT1 or 2 serial port	Check cables and port configuration
TSL2	This alarm is generated in case of a communication problem between the two IDUs of the link	Establish the link (several possible caujses)

4.5.2 – Direct and Indirect Alarms

There are two type of alarms :

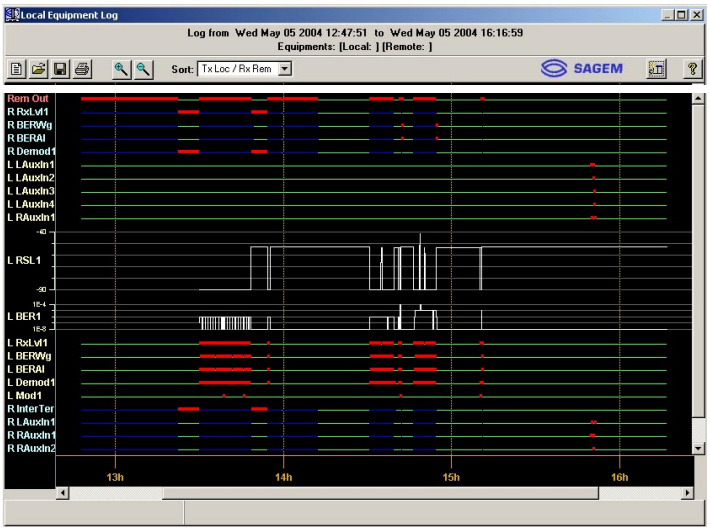
- Direct alarms which occur when there is a fault on the unit (i.e. transmit frequency alarm)
- Indirect alarms caused by an other module failure, or by a missing unit or by a propagation problem (RSL alarm, BER alarm, demodulation alarm….)

To determine the cause of an indirect alarm, it is necessary to analyze all possible causes which can cause such an alarm, and to select the most probable.

.

4.5.3 – Equipment Log

The view equipment log feature is also very useful to determine graphically the cause of a problem, because all active alarms are displayed versus time.



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See chapter 3 section 3.3.3.3 for description.

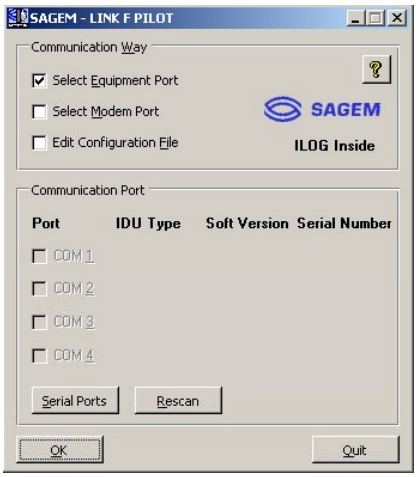
4.6 – Typical SAGEM-LINK F Pilot Screens

The following screens are representative to typical problems which could happen.

4.6.1 – No connection to the IDU from the Pilot software

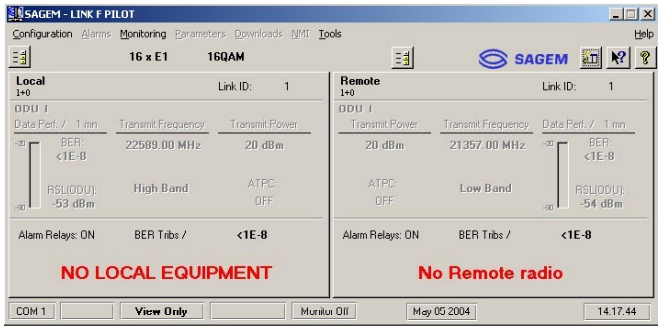
When connecting a PC on a SAGEM-LINK F IDU, and running SAGEM-LINK F Pilot, the following typical screens may appear :

- The Pilot software does not recognize the equipment : check serial cable between IDU and PC, and verify that you are using a valid COM port (see chapter3, section 3.2.1)



4.6.2 – No Local equipment

The IDU is recognized by the Pilot software, but there is a local ODU problem or no local ODU connected : check IDU to ODU cable. If the problem persists, replace the ODU.



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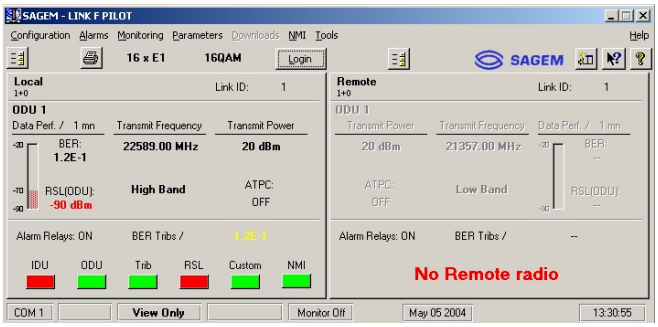
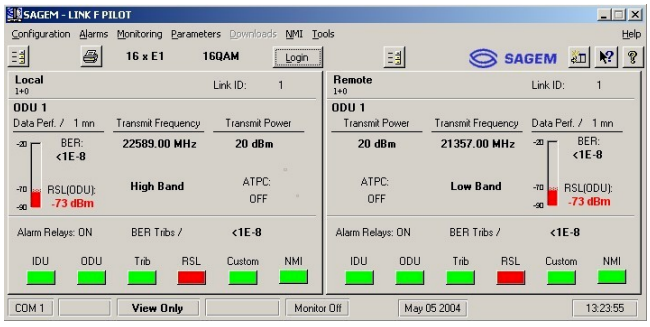
4.6.3 – No Remote Radio

The local radio is operating, but there is no communication with the remote terminal : verify remote terminal configuration, antenna alignment, radio path obstructions.



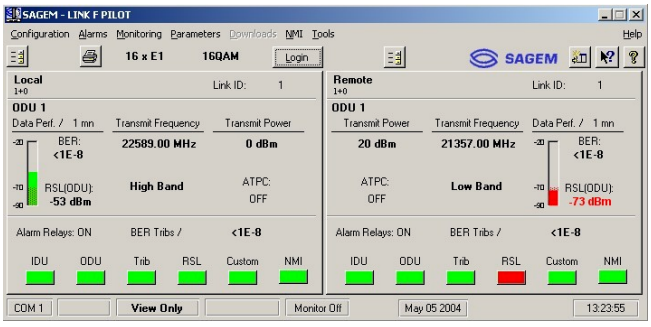
4.6.4 – RSL Alarms

The link is established with a too low receive level causing RSL alarm. Check antenna alignment, or a propagation problem.



4.6.5 – Transmit Power alarm

The link is established with a RSL alarm only on one side of the link. Check transmit power configuration.



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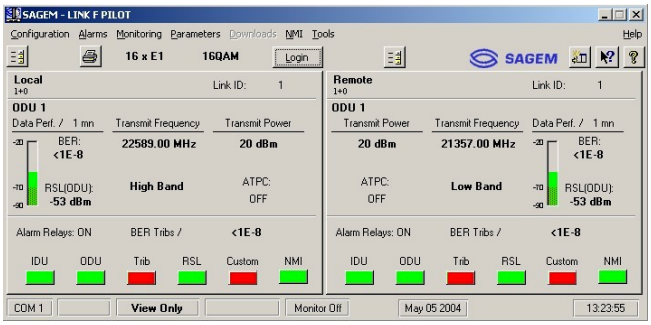
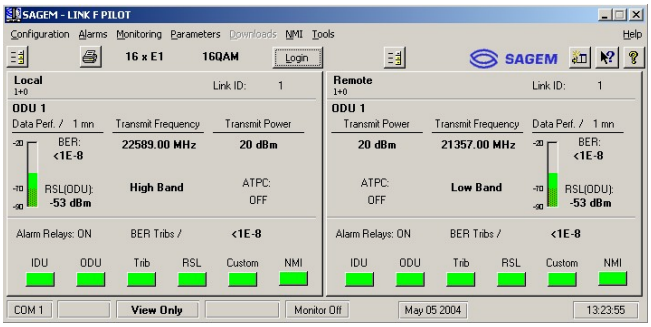
4.6.6 – Minor alarms

The link is established with some minor alarms. Check configuration to clear these alarms



4.6.7 – No alarm

The link is established without alarms, with a proper configuration : all indicators are green.



4.4 – Replacing an ODU

To replace an ODU it is necessary to apply the following procedure :

1- Switch off the cable interface module which is connected to the ODU to be replaced.
2- Disconnect the IDU cable from the ODU
3- Note ODU polarization and remove ODU from its support (antenna, coupler or remote mount)
4- Install a new ODU according to installation procedure (Chapter 1 section 1.5), in the same polarization.
5- Connect ODU cable and protect connectors with isolation tape
6- Switch on the cable interface module

Warning : Before disconnecting the cable, be sure that Cable Interface module is switched off

Note : for a 1+1 system, an ODU replacement can be done while the other operating. Prior to remove an ODU, use the manual switch control (see chapter 3 section 3.3.7.2) and select the transmitter and receiver of the ODU still in traffic.
Once the change has been done, replace switch control in automatic position.

4.5 – Replacing a Cable Interface module

To replace a cable interface module it is necessary to apply the following procedure :
1- switch off the cable interface module
2- Disconnect ODU cable (at IDU access)
3- Remove the two screws
4- Remove the cable interface module and replace it by a new one.
5- Attach the module with the screws and connect the ODU cable
6- Switch on the cable interface module

Warning : Before disconnecting the cable, be sure that Cable Interface module is switched off

Note : for a 1+1 system, a cable interface replacement can be done while the other operating. Prior to remove a cable interface module, use the manual switch control (see chapter 3 section 3.3.7.2) and select the transmitter and receiver of the channel still in traffic.
Once the change has been done, replace switch control in automatic position.

4.6 – Replacing an IDU

To replace an IDU, it is necessary to apply the following procedure :
1- Be sure to have a configuration file which will make re installation easier. If it is possible, go to the menu Configuration / Save as/ Local (refer to chapter 3 section 3.3.1.2.)
2- Switch off the cable interface module(s)
3- Remove all cables from the IDU
4- Remove IDU.
5- Remove Cable Interface module(s) from IDU and replace them into the new IDU.
6- Replace the new IDU, and connect all cables like there were before the replacement.
7- Switch on the IDU and load the configuration information which was previously saved. If this file is not available, it will be necessary to proceed to a new installation (refer to chapter 3 Section 3.2)

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Chapter 5

System Description

5.1 - Overview

SAGEM-LINK F is a digital radio relay system designed to meet the needs of a continuously evolving networks market and guarantees quality and reliability for short and medium distance point to point links.

SAGEM-LINK F is available in unprotected 1+0 configuration or in protected 1+1 configuration (Mute Hot Standby, Space Diversity, Frequency Diversity).

- Major telecommunication bands are covered : 7, 8, 13, 15, 18, 23, 26 and 38 GHz
- Traffic : 2 E1, 4 E1, 8 E1, 16 E1, Ethernet 100 baseT
- Modulation : QPSK, 16QAM (8 E1 and 16 E1)
- Integrated BER and receive signal level measurement
- 30 dB transmit power range in steps of 1 dB
- Automatic Transmit Power Control (ATPC)
- Synthesizer Frequency Step : 250 kHz
- Full software control
- Full compliance with ETSI standards

In addition some additional features are included :

- 3 auxiliary data channels
- 4 Input / Output dry loops
- 1 engineering order wire
- SNMP interface with 10 baseT integrated hub, and two serial ports

5.2 – System Composition

SAGEM-LINK F unprotected and protected configurations are obtained by using the same basic system components :

- **IDU** including the user interfaces, microprocessor, multiplexer and demultiplexer.
- **Cable Interface Module** including DC power supply, modem and ODU cable interface
- **ODU** including IDU cable interface and RF circuits (synthesizers, transmitter, receiver).

A 1+0 terminal using an integrated antenna is presented on Figure 5.1, and a 1+1 hot standby terminal using a coupler and an integrated antenna is presented on Figure 5.2.

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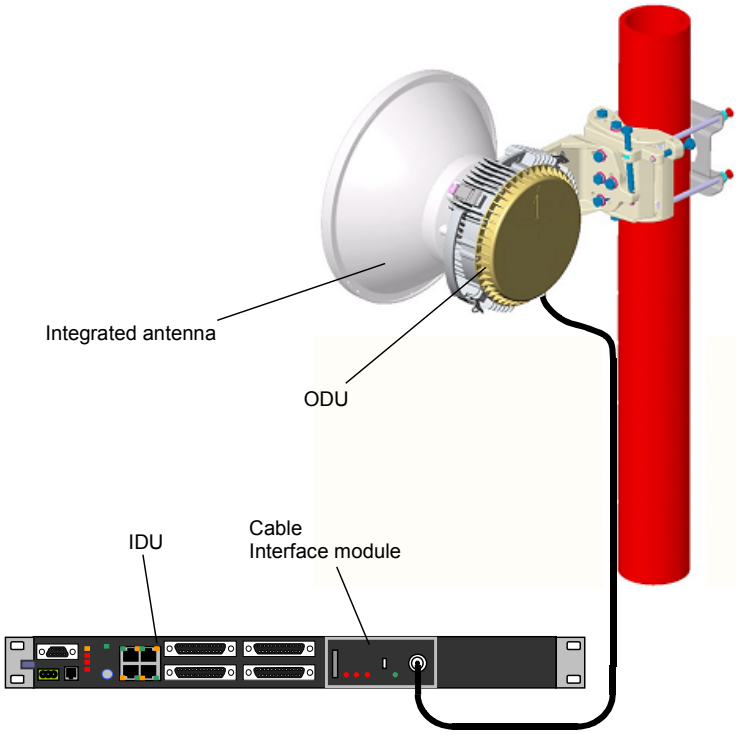

Figure 5.1 SAGEM-LINK F 1+0 Terminal

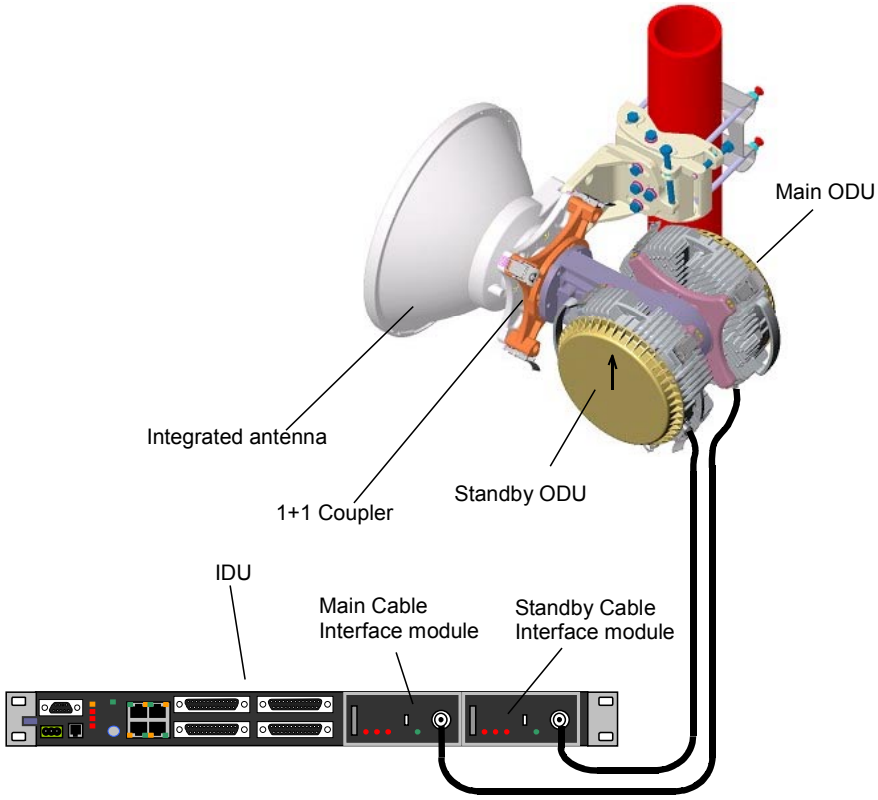

Figure 5.2 SAGEM-LINK F 1+1 Terminal (MHSB)

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5.2.1 - IDU Versions

Three IDU versions are available :

- **UFX-L** : 2x2 / 4x2 Mbit/s
- **UFX-S** : 2x2 / 4x2 / 8x2 / 16x2 Mbit/s
- **UFX-E** : 2x2 / 4x2 / 8x2 / 16x2 Mbit/s and Ethernet 100 baseT

5.2.2 – Cable Interface Module Versions

Three cable interface module versions are available

- **UFC-L** : QPSK - 2x2 / 4x2 Mbit/s
- **UFC-S** : QPSK - 2x2 / 4x2/ 8x2 / 16x2 Mbit/s
- **UFX-H** : QPSK - 2x2 / 4x2/ 8x2 / 16x2 Mbit/s and 16 QAM 8x2 / 16x2 Mbit/s

5.2.3 – ODU Versions

The available frequency bands for SAGEM-LINK F radios are 7 GHz, 8 GHz, 13 GHz, 15 GHz, 18 GHz, 23 GHz, 26 GHz and 38 GHz.

Each frequency band is divided in several sub bands. For each sub band, there is one Low Band ODU and one high band ODU.

The complete ODU list is given in appendix1.

The ODU minimum and maximum frequencies indicated in this list correspond to the diplexer useful bandwidth.

The minimum and maximum channel frequencies for each ODU depend on the channel occupied bandwidth (3.5, 7, 14 or 28 MHz). See figure 5.3.

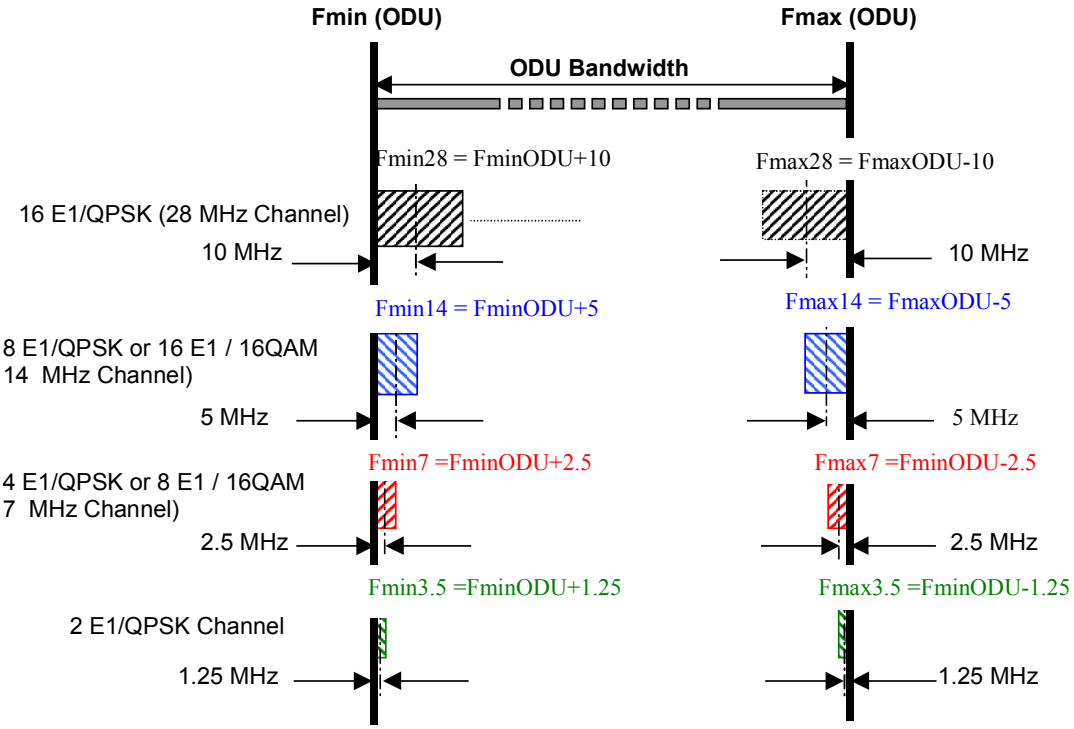

Figure 5.3 Minimum and Maximum Channel Frequencies

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- The minimum 28 MHz channel frequency is fmin ODU + 10 MHz , and the maximum channel frequency is fmaxODU -10 MHz
- The minimum 14 MHz channel frequency is fmin ODU + 5 MHz , and the channel frequency is fmaxODU -5 MHz
- The minimum 7 MHz channel frequency is fmin ODU + 2.5 MHz , and the maximum channel frequency is fmaxODU -2.5 MHz
- The minimum 3.5 MHz channel frequency is fmin ODU + 1.25 MHz , and the channel frequency is fmaxODU -1.25 MHz

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5.3 – SAGEM-LINK F Block Diagram

The SAGEM-LINK F Block Diagrams are given in Figure 5.4 (1+0 configuration) and Figure 5.5 (1+1 configuration).

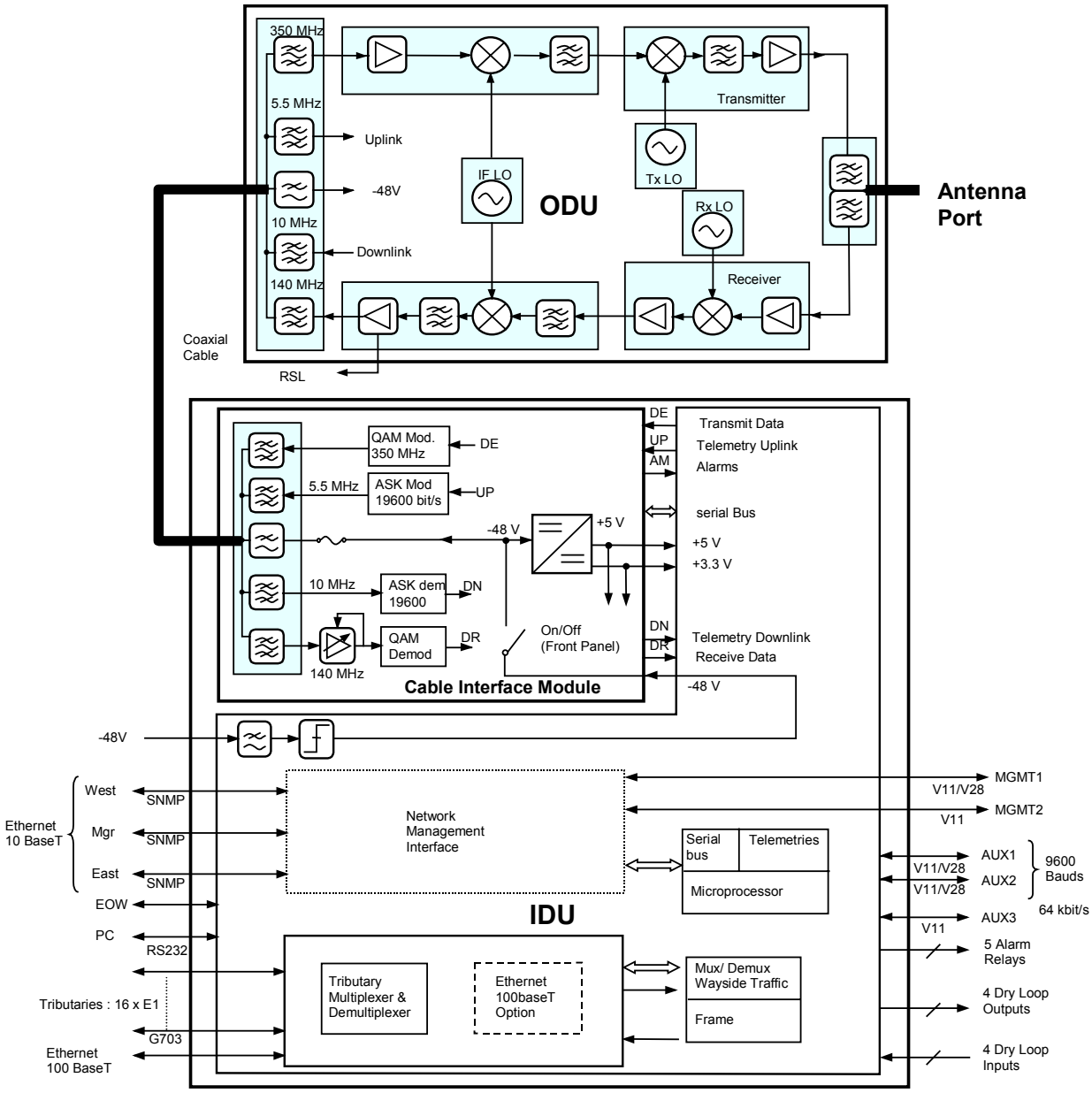

Figure 5.4 – SAGEM-LINK F Block Diagram (1+0)

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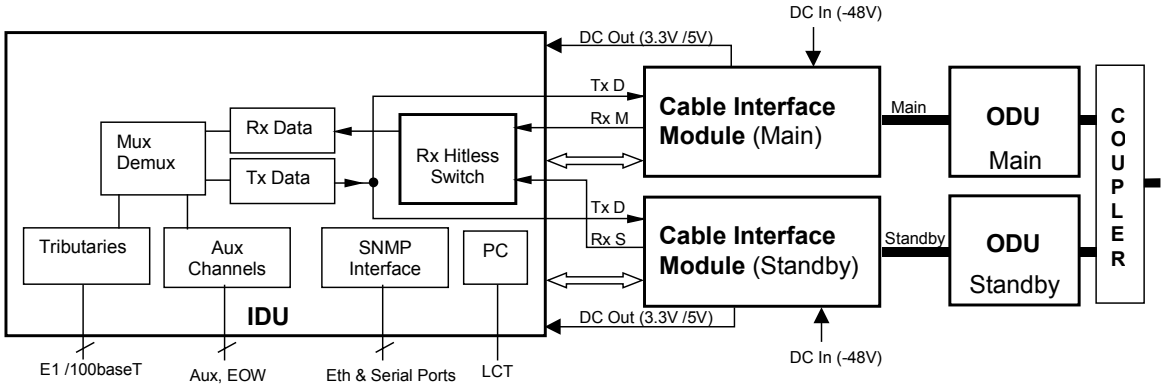

Figure 5.5 – SAGEM-LINK F 1+1 Block Diagram (1+1)

5.4 – IDU Description

The **IDU**, which is frequency independent, consist of a 19 inches rack, including :

- All user interface access (tributaries, auxiliary channels, relays and dry loops, EOW, SNMP management ports, PC serial port)
- A Microprocessor controlling the whole system, and communicating with the ODU, the remote IDU, the SNMP agent, and the SAGEM-LINK F Pilot software.
- A flexible E1 multiplexer / demultiplexer (2 E1, 4 E1, 8 E1, 16 E1)
- A wayside traffic multiplexer including :
  - Two Auxiliary channels (**AUX1** and **AUX2**) : 9600 bauds with V11 / V28 interfaces (controlled by software).
  - One Auxiliary channel (**AUX3**) : 64 kbit/s with V11 interface, that can be configured in either co-directional or contra-directional mode
  - One point to point audio Engineer Order Wire (**EOW**)
- Optional **Ethernet 100 base T** interface. When this option is present, the IDU may configured with E1 interface only, with Ethernet interface only, or with a combination of E1 and Ethernet. All configurations are controlled by software.
- A **network management interface** compliant with SNMP protocol. The NMI interface has three Ethernet 10 BaseT ports (internal hub), two serial ports (MGMT1 and MGMT2), and TSL2 interface to dialog with the remote NMI interface via an internal auxiliary radio data channel. Once the user has configured the IP addresses and the routes, the NMI card acts as a router for management traffic.
- In addition, there are 5 internal configurable alarm relays, and 4 Inputs / Outputs dry loops.

The **IDU** can contain one or two cable interface modules depending on the system configuration. These modules are plugged into the IDU rack.

Refer to chapter1 for access interfaces details.

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5.5 – Cable Interface Module Description

The **Cable Interface module**, which is frequency independent, is plugged into an IDU rack. It consist of :

- **ODU cable interface** which multiplexes in frequency 5 signals in order to transmit them on a single 50 ohm coaxial cable. These signals are :
  - DC voltage (-48V) to supply the ODU
  - Transmit IF which is a QPSK or a 16QAM modulated carrier at 350 MHz frequency
  - Telemetry uplink (5.5 MHz) which contains all control signals from IDU to ODU
  - Receive IF (modulated carrier at 140 MHz)
  - Telemetry downlink (10 MHz) which carries information returned from the ODU to the IDU (alarms, receive signal level).

- **A 350 MHz QPSK / 16QAM modulator** including :
  - An Reed Solomon FEC encoder (204, 188, 8)
  - A scrambler and a digital filter
  - A 350 MHz I/Q modulator

- **A 140 MHz QPSK / 16QAM demodulator** including :
  - Zero IF down conversion
  - Adaptive equalizer
  - Carrier and Clock digital recovery
  - Reed Solomon FEC decoder
  - Descrambler
  - BER indication

- **A DC- DC power supply**, feeding the cable interface module and the rest of the IDU. In 1+1 systems, the IDU is supplied by two power supply from the main and the standby cable interface modules. A hot swap feature is implemented in order to avoid any disturbance on traffic while being in maintenance operation.

5.6 – Outdoor Unit Description

The **Outdoor Unit**, which is capacity independent, is an integrated unit consisting of :

- **IDU cable Interface** which is the reverse of Cable Interface module :
  - DC voltage Input (-48V) to supply the ODU
  - 350 MHz Transmit IF input
  - Telemetry uplink (5.5 MHz) which contains all control signals from IDU to ODU
  - 140 MHz Receive IF output

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- Telemetry downlink (10 MHz) which carries information returned from the ODU to the IDU (alarms, receive signal level).

- **Transmitter** using two frequency conversions. Minimum frequency step is 250 kHz
- **Diplexer**
- **Receiver** using two frequency conversion
- **Power supply**
- **Microcontroller** which controls the ODU and communicates with the IDU

5.7 – Protected Configurations

Three protected configuration are available : 1+1 Mute Hot Standby, 1+1 Space Diversity, 1+1 Frequency diversity.
Protection switching detects failures on the units and route data to provide the best service.

5.7.1 – 1+1 Mute Hot Standby (MHSB)

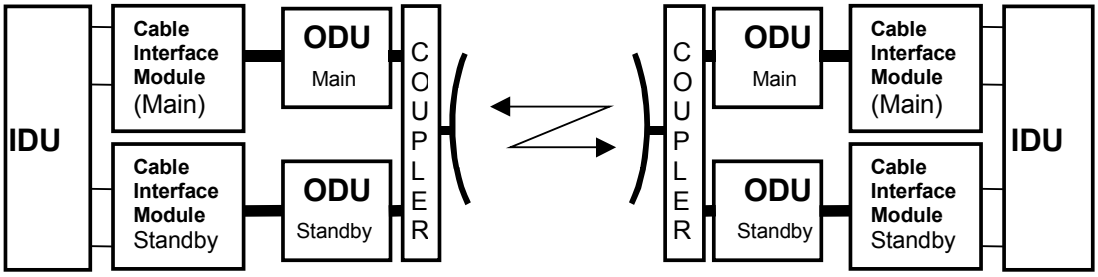

Figure 5.6 SAGEM-LINK F 1+1 HSB Configuration

The 1+1 MHSB configuration involves the following principles :

- Main and standby units work at the same frequency, and are connected to the antenna with a coupler (6dB, 3dB or 10dB coupling),
- When one transmitter is in traffic, the other is in mute position
- Both receivers are continuously operating
- Transmitter and receiver protection switch controls are independent. It is possible to have main transmitter in traffic, with standby receiver operating.
- Transmitter and receiver protection switches are controlled by the local terminal only. The remote terminal does not control local transmitter protection switch
- Transmitter and receiver protection switches can be controlled manually with the Pilot software
- Receiver switch has hitless features : when there is no failure on one receiver, there is no error during receiver switching operation.

5.7.2 – 1+1 Space Diversity

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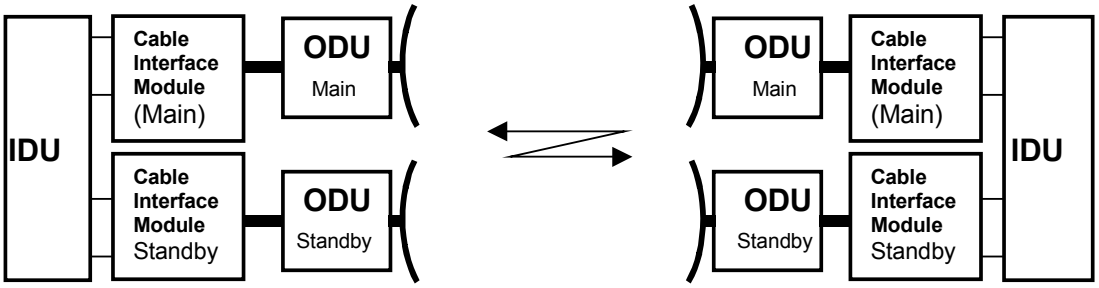

Figure 5.7 SAGEM-LINK F 1+1 SD Configuration

The 1+1 Space Diversity is a 1+1 Mute hot standby system, without coupler and with a second antenna.
One couple of frequencies is involved, one of the two transmitter is in mute position.

This system is mainly used in case of propagation problem (long hop multiple paths). The switching criteria is the same compared to MHSB protection system. However, an optional criteria is available for diversity configurations : receive signal level.(see Chapter 3, section 3.3.7.3).

5.7.3 – 1+1 Frequency Diversity

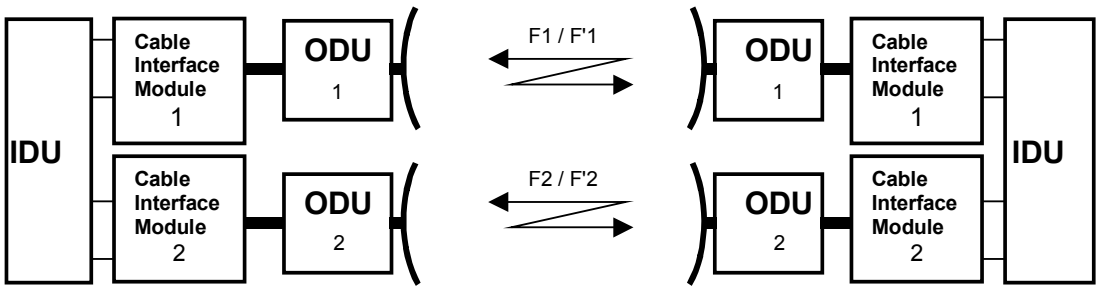

Figure 5.8 SAGEM-LINK F 1+1 FD Configuration (2 antennas per terminal)

OR

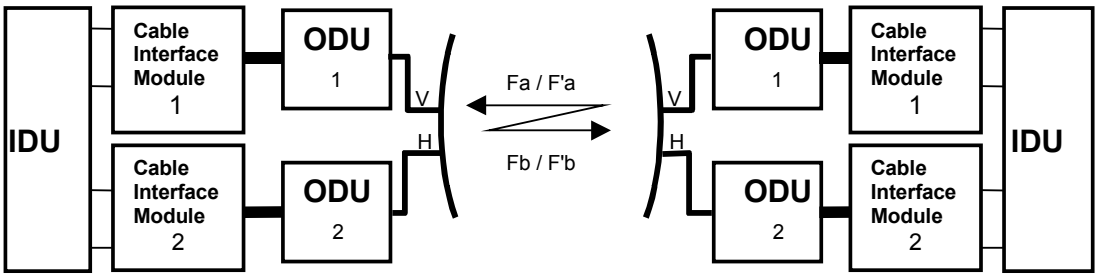

Figure 5.9 SAGEM-LINK F 1+1 FD Configuration (1 dual polarized antenna)

In frequency diversity systems, two couples of frequency are used. There is no switching at the transmit side, both transmitters are operating. There is only a protection switch for the receivers.

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Appendix 1

SAGEM-LINK F Specifications

General

Versions and configurations	Frequency bands	7, 8, 13, 15, 18, 23, 26, 38 GHz
	Bitrates	2x to 16x 2 Mbit/s, software-selectable
		2x to 16x 2 Mbit/s + 100 base T, software-selectable
Protection schemes	1+0	Unprotected
	1+1	Mute Hot standby (MHSB)
		Frequency or space diversity
Applicable ETSI standards	7, 8 GHz	EN 301 216
	13, 15, 18 GHz	EN 301 128
	23 GHz	EN 300 198
	26 GHz	EN 300 431
	38 GHz	EN 300 197
Frequency bands	7 GHz	7.1 GHz to 7.9 GHz
	8 GHz	8.0 GHz to 8.5 GHz
	13 GHz	12.75 GHz to 13.25 GHz
	15 GHz	14.4 GHz to 15.35 GHz
	18 GHz	17.7 GHz to 19.7 GHz
	23 GHz	21.2 GHz to 23.6 GHz
	26 GHz	24.5 GHz to 26.5 GHz
	38 GHz	37 GHz to 39.5 GHz
Tx-Tx Spacing QPSK	2x 2 Mbit/s or nx2 Mbit/s + 100BT	3,5 MHz
	4x 2 Mbit/s or nx2 Mbit/s + 100BT	7 MHz
	8x 2 Mbit/s or nx2 Mbit/s + 100BT	14 MHz (13.75 MHz @ 18 GHz)
	16x 2 Mbit/s or nx2 Mbit/s + 100BT	28 MHz (27.5 MHz @ 18 GHz)
Tx-Tx Spacing 16QAM	8x 2 Mbit/s or nx2 Mbit/s + 100BT	7 MHz
	16x 2 Mbit/s or nx2 Mbit/s + 100BT	14 MHz (13.75 MHz @ 18 GHz)
Tx-Rx Spacing	7 GHz	161 MHz, 154 MHz
	8 GHz	119 MHz, 126 MHz, 208 MHz
	13 GHz	266 MHz
	15 GHz	420, 490, 644, 728 MHz
	18 GHz	1010 MHz
	23 GHz	1008, 1200, 1232 MHz
	26 GHz	1008 MHz
	38 GHz	1260 MHz
Modulation	QPSK and 16 QAM	
Forward Error Correction	RS (204, 188, 8)	Interleaved or not (Controlled by software)
Frequency tuning range	Refer to appendix 2 and Chapter 5, section 5.2.3	

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Transmitter

Output power			
Measured at ODU Output		**QPSK**	**16QAM**
Tolerance +/- 2 dB			
7, 8 GHz		27 dBm	21 dBm
13, 15, 18 GHz		26 dBm	20 dBm
23 GHz		24 dBm	18 dBm
26, 38 GHz		20 dBm	14 dBm
Minimum Output Power		-4 dBm	
Power Step		1 dB	
Automatic Tx Power Control (ATPC algorithm)	Adaptive adjustment range	20 dB max*	
	Manual adjustment range	10 dB max*	
Output power with Transmit Mute		<-30 dBm	
Frequency Synthesizer Step		250 kHz	
Frequency Stability		± 10 ppm	

* Note : Within ODU Transmit Power Range (Max Power – Min Power)

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Receiver

Maximum Non Destructive Receive Level		0 dBm	
Maximum Receive Level for BER < 10^{-3}		-20 dBm (QPSK)	
Minimum Receive Level for BER < 10^{-3} **1+0, 1+1 SD, 1+1 FD, ODU access**		***QPSK***	***16QAM***
		Typical / Guaranteed	***Typical / Guaranteed***
7, 8, 13, 15 GHz	2x 2 Mbit/s	-93 / -91 dBm	NA
	4x 2 Mbit/s	-90 / -88 dBm	NA
	8x 2 Mbit/s	-87 / -85 dBm	-83 / -81 dBm
	34 or 16x 2 Mbit/s	-84 / -82 dBm	-80 / -78 dBm
18, 23, 26 GHz	2x 2 Mbit/s	-92 / -90 dBm	NA
	4x 2 Mbit/s	-89 / -87 dBm	NA
	8x 2 Mbit/s	-86 / -84 dBm	-82 / -80 dBm
	34 or 16x 2 Mbit/s	-83 / -81 dBm	-79 / -77 dBm
38 GHz	2x 2 Mbit/s	-91 / -89 dBm	NA
	4x 2 Mbit/s	-88 / -86 dBm	NA
	8x 2 Mbit/s	-85 / -83 dBm	-81 / -79 dBm
	34 or 16x 2 Mbit/s	-82 / -80 dBm	-78 / -76 dBm
Minimum Receive Level for BER < 10^{-3} **1+1 MHSB, Main ODU access (with 6 dB coupler)**		***QPSK***	***16QAM***
		Typical / Guaranteed	***Typical / Guaranteed***
7, 8, 13, 15 GHz	2x 2 Mbit/s	-91.5 / -89.5 dBm	NA
	4x 2 Mbit/s	-88.5 / -86.5 dBm	NA
	8x 2 Mbit/s	-85.5 / -83.5 dBm	-81.5 / -79.5 dBm
	34 or 16x 2 Mbit/s	-82.5 / -80.5 dBm	-78.5 / -76.5 dBm
18, 23, 26 GHz	2x 2 Mbit/s	-90.5 / -88.5 dBm	NA
	4x 2 Mbit/s	-87.5 / -85.5 dBm	NA
	8x 2 Mbit/s	-84.5 / -82.5 dBm	-80.5 / -78.5 dBm
	34 or 16x 2 Mbit/s	-81.5 / -79.5 dBm	-77.5 / -75.5 dBm
38 GHz	2x 2 Mbit/s	-89.5 / -87.5 dBm	NA
	4x 2 Mbit/s	-86.5 / -84.5 dBm	NA
	8x 2 Mbit/s	-83.5 / -81.5 dBm	-79.5 / -77.5 dBm
	34 or 16x 2 Mbit/s	-80.5 / -78.5 dBm	-78.5 / -74.5 dBm
Threshold for BER @ 10^{-6}		Typical value : 1.5 dB above threshold for BER @ 10^{-3}	
Residual Bit Error Rate		$<10^{-11}$	

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Tributaries

Interface types	2x 2, 4x 2, 8x2 or 16x 2 Mbit/s 120 Ω or 75 Ω Ethernet 100 base T	
Physical and electrical specifications	ITU-T	G.703 (2 Mbit/s)
Physical and electrical specifications	IEEE	IEEE 802.3

Auxiliary Channels and Management Interfaces

Engineering Orderwire	**1**	point-to-point	RJ11
9600 bit/s Auxiliary Channels	**2**	V.11/V.28	DB9
64 kit/s Auxiliary Channel	**1**	V.11 co/contra - directional	DB15
Alarm Relays	**5**	interface relay contacts	DB37
Input Dry Loops	**4**	interface relay contacts	"
Output Dry Loops	**4**	interface relay contacts	"

Management Interfaces		PC port V.24/V.28	DB9
Management channels			
	10 Mbit/s Ethernet interfaces		RJ45
	9600 to 115200 bit/s MGMT1 interfaces		V.11 or V.24/V.28 DB25
	9600 to 115200 bit/s MGMT2 interfaces		V.11/DB25

Mechanical

Dimensions		
Indoor Unit	1U, 19-inch :	44(H) x 485 (L) x 300 (P) mm
Outdoor Units		267 mm Diameter, Height : 89 mm
Weight		
Indoor Units		3.5 kg
Outdoor Units (all frequencies)		5 kg
Installation		
Indoor Units	19-inch racks	
Outdoor Units and antennas	50 to 115 mm poles	
Indoor Unit-to-Outdoor Unit interconnection		
1+0	1 coaxial cable	
1+1	2 coaxial cables	
Impedance	50 Ω	
Length	up to 600 m depending on cable type	
Examples		
Belden 9914 / VDC=-48V	≤ 230 m	
Andrew LDF 4-50/ VDC=-48V	≤ 600 m	

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Consumption

DC Voltage Input	-36 V to -59 V	
Power consumption	1+0 standard	IDU < 25 W ODU < 40W

Environmental

Environmental Conditions	(Applicable ETSI standard)	
	Indoor Unit	ETS 300 019 class 3.1
	Outdoor Unit	ETS 300 019 class 4.1
Temperature Range	Indoor Unit	-10°C to+50°C
	Outdoor Unit	-33°C to+55°C
Electromagnetic Compatibility (Applicable ETSI standard)		
	Transmission	EN 301 489-1/4
	Immunity	EN 301 489-1/4

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Appendix 2

SAGEM-LINK F Part Numbers

Link Composition

Depending on the configuration, a SAGEM-LINK F link (two terminals) is composed of the following items :

SAGEM LINK F			Reference	ODU				Cable Interface			IDU			
				HB	LB	HB	LB	QPSK 4E1	QPSK	16QAM	2/4E1	E1	E1 / Eth	UFDxxC6 (Coupler)
				UFHxx	UFBxx	UFHxx+Ext	UFBxx+Ext	UFC_L	UFC_S	UFC_H	UFX_L	UFX_S	UFX_E	
1+0	2/4xE1	QPSK	UFL-bb-SLN-cccc-dd	1	1			2			2			
	nxE1	QPSK	UFL-bb-SSN-cccc-dd			1	1		2			2		
	nxE1	16QAM / QPSK	UFL-bb-HSN-cccc-dd			1	1			2		2		
	nxE1+100BT	QPSK	UFL-bb-SEN-cccc-dd			1	1		2				2	
	nxE1+100BT	16QAM / QPSK	UFL-bb-HEN-cccc-dd			1	1			2			2	
1+1 HSB one antenna 6dB Coupler	2/4xE1	QPSK	UFL-bb-SLH-cccc-dd	2	2			4			2			2
	nxE1	QPSK	UFL-bb-SSH-cccc-dd			2	2		4			2		2
	nxE1	16QAM / QPSK	UFL-bb-HSH-cccc-dd			2	2			4		2		2
	nxE1+100BT	QPSK	UFL-bb-SEH-cccc-dd			2	2		4				2	2
	nxE1+100BT	16QAM / QPSK	UFL-bb-HEH-cccc-dd			2	2			4			2	2
1+1 SD (two antennas)	2/4xE1	QPSK	UFL-bb-SLS-cccc-dd	2	2			4			2			
	nxE1	QPSK	UFL-bb-SSS-cccc-dd			2	2		4			2		
	nxE1	16QAM / QPSK	UFL-bb-HSS-cccc-dd			2	2			4		2		
	nxE1+100BT	QPSK	UFL-bb-SES-cccc-dd			2	2		4				2	
	nxE1+100BT	16QAM / QPSK	UFL-bb-HES-cccc-dd			2	2			4			2	
1+1 FD (no coupler)	2/4xE1	QPSK	UFL-bb-SLF-cccc-dd	2	2			4			2			
	nxE1	QPSK	UFL-bb-SSF-cccc-dd			2	2		4			2		
	nxE1	16QAM / QPSK	UFL-bb-HSF-cccc-dd			2	2			4		2		
	nxE1+100BT	QPSK	UFL-bb-SEF-cccc-dd			2	2		4				2	
	nxE1+100BT	16QAM / QPSK	UFL-bb-HEF-cccc-dd			2	2			4			2	

With :

UFL-bb-XYZ-cccc-dd-ff		
bb	Frequency Band (GHz)	07, 08, 13, 15, 18, 23, 26, 38
X	**S** : QPSK, **H** : 16QAM	
Y	**L** : 2/4xE1, **S** : nxE1, **E** : Ethernet + nxE1	
Z	**N** : 1+0, **H** : 1+1 HSB, **S** : 1+1 SD, **F** : 1+1 FD	
cccc	TR Spacing	
dd	Sub band	01, 02,…
ff	Channel 2 Sub Band (1+1 FD only)	01, 02,…

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SAGEM LINK F Modules Part Numbers

Description	SAGEM Reference	Part Number
IDU 2/4xE1, multiplexer, including 1/2 power supply cable	UFX_L	251320656
IDU nxE1, multiplexer, including 1/2 power supply cable	UFX_S	251320913
IDU nxE1+Ethernet multiplexer, including 1/2 power supply cable, and Ethernet cable	UFX_E	251398141
7 to 38 GHz ODU	UFH-bb-cccc-dd-ee, (High Band ODU) UFB-bb-cccc-dd-ee, (Low Band ODU)	Refer to ODU Table
Cable Interface Module QPSK 2/4 E1	UFC_L	251319926
Cable Interface Module QPSK	UFC_S	288052926
Cable Interface Module 16QAM	UFC_H	251322704
Connection kit : 1 terminal SLF 1+0 SAGEM LINK F PILOT, 2 N connectors kit, earthing kit cable (2), earthing kit ODU (1), self-vulcanizing tape ...	UFK_S1	251383249
Connection kit : 1 terminal SLF 1+1 SAGEM LINK F PILOT, 4 N connectors kit, earthing kit cable (4), earthing kit ODU (2), self-vulcanizing tape ...	UFK_S2	251383252
Light Connection kit : 1 terminal SLF 1+0 SAGEM LINK PILOT, earthing kit ODU (1)	UFK_A1	251 383 260
Light Connection kit : 1 terminal SLF 1+1 SAGEM LINK F PILOT, earthing kit ODU (2)	UFK_A2	251 383 273
1+1 Coupler	UFDxCv x=7W, 13, 15, 18, 23, 26, 38 v= 06 (coupling ratio) 2 digits 7W : 07 or 08	See Table below
Pole mounting : 1 ODU Strictly needed with antenna's diameter > 1.8m	UFPx x=7W, 13, 15, 18, 23, 26, 38 7W : 07 or 08	See Table below
90 cm Flex-Twist	UFGx/90 x=7W, 13, 15, 18, 23, 26, 38	See Table below
5m long 120 ohm 2Mbit/s cable (HE5 cable - free ends) 4x 2Mbit/s IDU		55670183
5m long 75 ohm 2Mbit/s port cable (HE5 cable - BNC plug) 4x 2Mbit/s		55670405-5M0
Belden 9914 coaxial cable with cable clamp per m		06965380

Description	SAGEM Reference	Part Number
Couplers	UFD7WC06	251396064
	UFD13C06	251396072
	UFD15C06	251396085
	UFD18C06	251396093
	UFD23C06	251396105
	UFD26C06	251396118
	UFD38C06	251396126
Pole mounting	UFP7W	251396139
	UFP13	251396147
	UFP15	251396168
	UFP18	251396171
	UFP23	251396189
	UFP26	251396192
	UFP38	251396209
Flex-Guide	UFG7W/90 (flange = PBR84)	251396233
	UFG13/90 (flange = PBR120)	251396241
	UFG15/90 (flange = PBR140)	251396254
	UFG18/90 (flange = PBR220)	251396275
	UFG23/90 (flange = PBR220)	251396283
	UFG26/90 (flange = PBR220)	251396296
	UFG38/90 (flange = PBR320)	251396402

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SAGEM LINK F ODU Part Numbers

SAGEM Model	Part Number	SAGEM Description	Transmit Range (1)		TR Spacing (MHz)
			Min Freq (MHz)	Max Freq (MHz)	
7 GHz ODUs					
UFB07-A154-01-00	251307294	ODU SLF 07GHZ TR A154 LO B1	7 428.0	7 484.0	154
UFH07-A154-01-00	251307400	ODU SLF 07GHZ TR A154 HI B1	7 582.0	7 638.0	154
UFB07-A154-02-00	251307418	ODU SLF 07GHZ TR A154 LO B2	7 470.0	7 526.0	154
UFH07-A154-02-00	251307421	ODU SLF 07GHZ TR A154 HI B2	7 624.0	7 680.0	154
UFB07-A154-03-00	251307439	ODU SLF 07GHZ TR A154 LO B3	7 512.0	7 568.0	154
UFH07-A154-03-00	251307442	ODU SLF 07GHZ TR A154 HI B3	7 666.0	7 722.0	154
UFB07-A160-01-00	251305943	ODU SLF 07GHZ TR A160 LO B1	7 433.5	7 496.5	160
UFH07-A160-01-00	251305951	ODU SLF 07GHZ TR A160 HI B1	7 593.5	7 656.5	160
UFB07-A160-02-00	251305964	ODU SLF 07GHZ TR A160 LO B2	7 478.5	7 541.5	160
UFH07-A160-02-00	251305972	ODU SLF 07GHZ TR A160 HI B2	7 638.5	7 701.5	160
UFB07-A160-03-00	251305985	ODU SLF 07GHZ TR A160 LO B3	7 526.0	7 589.0	160
UFH07-A160-03-00	251305993	ODU SLF 07GHZ TR A160 HI B3	7 686.0	7 749.0	160
UFB07-A161-01-00	251306804	ODU SLF 07GHZ TR A161 LO B1	7 117.0	7 180.0	161
UFH07-A161-01-00	251306825	ODU SLF 07GHZ TR A161 HI B1	7 278.0	7 341.0	161
UFB07-A161-02-00	251306838	ODU SLF 07GHZ TR A161 LO B2	7 159.0	7 222.0	161
UFH07-A161-02-00	251306846	ODU SLF 07GHZ TR A161 HI B2	7 320.0	7 383.0	161
UFB07-A161-03-00	251306859	ODU SLF 07GHZ TR A161 LO B3	7 198.0	7 261.0	161
UFH07-A161-03-00	251306867	ODU SLF 07GHZ TR A161 HI B3	7 359.0	7 422.0	161
UFB07-A161-04-00	251306870	ODU SLF 07GHZ TR A161 LO B4	7 213.0	7 276.0	161
UFH07-A161-04-00	251306888	ODU SLF 07GHZ TR A161 HI B4	7 374.0	7 437.0	161
UFB07-B161-01-00	251307210	ODU SLF 07GHZ TR B161 LO B1	7 417.0	7 480.0	161
UFH07-B161-01-00	251307228	ODU SLF 07GHZ TR B161 HI B1	7 578.0	7 641.0	161
UFB07-B161-02-00	251307231	ODU SLF 07GHZ TR B161 LO B2	7 459.0	7 522.0	161
UFH07-B161-02-00	251307249	ODU SLF 07GHZ TR B161 HI B2	7 620.0	7 683.0	161
UFB07-B161-03-00	251307252	ODU SLF 07GHZ TR B161 LO B3	7 498.0	7 561.0	161
UFH07-B161-03-00	251307260	ODU SLF 07GHZ TR B161 HI B3	7 659.0	7 722.0	161
UFB07-B161-04-00	251307273	ODU SLF 07GHZ TR B161 LO B4	7 513.0	7 576.0	161
UFH07-B161-04-00	251307281	ODU SLF 07GHZ TR B161 HI B4	7 674.0	7 737.0	161

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SAGEM Model	Part Number	SAGEM Description	Transmit Range (1)		TR Spacing (MHz)
			Min Freq (MHz)	Max Freq (MHz)	
8 GHz ODUs					
UFB08-A126-01-00	251308147	ODU SLF 08GHZ TR A126 LO B1	8 279.0	8 307.0	119 & 126
UFH08-A126-01-00	251308155	ODU SLF 08GHZ TR A126 HI B1	8 398.0	8 426.0	119 & 126
UFB08-A126-02-00	251308168	ODU SLF 08GHZ TR A126 LO B2	8 293.0	8 321.0	119 & 126
UFH08-A126-02-00	251308176	ODU SLF 08GHZ TR A126 HI B2	8 412.0	8 440.0	119 & 126
UFB08-A126-03-00	251308189	ODU SLF 08GHZ TR A126 LO B3	8 307.0	8 335.0	119 & 126
UFH08-A126-03-00	251308197	ODU SLF 08GHZ TR A126 HI B3	8 426.0	8 454.0	119 & 126
UFB08-A126-04-00	251610831	ODU SLF 08GHZ TR A126 LO B4	8 321.0	8 349.0	119 & 126
UFH08-A126-04-00	251610865	ODU SLF 08GHZ TR A126 HI B4	8 440.0	8 468.0	119 & 126
UFB08-A126-05-00	251610873	ODU SLF 08GHZ TR A126 LO B5	8 335.0	8 363.0	119 & 126
UFH08-A126-05-00	251610886	ODU SLF 08GHZ TR A126 HI B5	8 454.0	8 482.0	119 & 126
UFB08-A126-06-00	251610894	ODU SLF 08GHZ TR A126 LO B6	8 349.0	8 377.0	119 & 126
UFH08-A126-06-00	251610951	ODU SLF 08GHZ TR A126 HI B6	8 468.0	8 496.0	119 & 126
UFB08-A208-01-00	251307450	ODU SLF 08GHZ TR A208 LO B1	8 043.0	8 113.0	208
UFH08-A208-01-00	251307913	ODU SLF 08GHZ TR A208 HI B1	8 251.0	8 321.0	208
UFB08-A208-02-00	251307926	ODU SLF 08GHZ TR A208 LO B2	8 099.0	8 169.0	208
UFH08-A208-02-00	251307934	ODU SLF 08GHZ TR A208 HI B2	8 307.0	8 377.0	208

13 GHz ODUs					
UFB13-A266-01-00	251308209	ODU SLF 13GHZ TR A266 LO B1	12 751.0	12 814.0	266
UFH13-A266-01-00	251308212	ODU SLF 13GHZ TR A266 HI B1	13 017.0	13 080.0	266
UFB13-A266-02-00	251308220	ODU SLF 13GHZ TR A266 LO B2	12 807.0	12 870.0	266
UFH13-A266-02-00	251308064	ODU SLF 13GHZ TR A266 HI B2	13 073.0	13 136.0	266
UFB13-A266-03-00	251308072	ODU SLF 13GHZ TR A266 LO B3	12 863.0	12 926.0	266
UFH13-A266-03-00	251308085	ODU SLF 13GHZ TR A266 HI B3	13 129.0	13 192.0	266
UFB13-A266-04-00	251308093	ODU SLF 13GHZ TR A266 LO B4	12 919.0	12 982.0	266
UFH13-A266-04-00	251308303	ODU SLF 13GHZ TR A266 HI B4	13 185.0	13 248.0	266

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SAGEM Model	Part Number	SAGEM Description	Transmit Range (1)		TR Spacing (MHz)
			Min Freq (MHz)	Max Freq (MHz)	
15 GHz ODUs					
UFB15-A420-01-00	251308316	ODU SLF 15GHZ TR A420 LO B1	14 501.0	14 613.0	420
UFH15-A420-01-00	251308324	ODU SLF 15GHZ TR A420 HI B1	14 921.0	15 033.0	420
UFB15-A420-02-00	251308337	ODU SLF 15GHZ TR A420 LO B2	14 606.0	14 725.0	420
UFH15-A420-02-00	251308345	ODU SLF 15GHZ TR A420 HI B2	15 026.0	15 145.0	420
UFB15-A420-03-00	251308358	ODU SLF 15GHZ TR A420 LO B3	14 718.0	14 837.0	420
UFH15-A420-03-00	251308366	ODU SLF 15GHZ TR A420 HI B3	15 138.0	15 257.0	420
UFB15-A420-04-00	251385425	ODU SLF 15GHZ TR A420 LO B4	14 816.0	14 928.0	420
UFH15-A420-04-00	251385412	ODU SLF 15GHZ TR A420 HI B4	15 236.0	15 348.0	420
UFB15-A490-01-00	251308379	ODU SLF 15GHZ TR A490 LO B1	14 403.0	14 522.0	490
UFH15-A490-01-00	251308387	ODU SLF 15GHZ TR A490 HI B1	14 893.0	15 012.0	490
UFB15-A490-02-00	251308390	ODU SLF 15GHZ TR A490 LO B2	14 515.0	14 634.0	490
UFH15-A490-02-00	251308506	ODU SLF 15GHZ TR A490 HI B2	15 005.0	15 124.0	490
UFB15-A490-03-00	251308514	ODU SLF 15GHZ TR A490 LO B3	14 627.0	14 746.0	490
UFH15-A490-03-00	251308535	ODU SLF 15GHZ TR A490 HI B3	15 117.0	15 236.0	490
UFB15-A490-04-00	251385433	ODU SLF 15GHZ TR A490 LO B4	14 739.0	14 858.0	490
UFH15-A490-04-00	251385446	ODU SLF 15GHZ TR A490 HI B4	15 229.0	15 348.0	490
UFB15-A728-01-00	251308717	ODU SLF 15GHZ TR A728 LO B1	14 500.0	14 615.0	728
UFH15-A728-01-00	251308725	ODU SLF 15GHZ TR A728 HI B1	15 228.0	15 343.0	728

18 GHz ODUs					
UFB18-1010-01-00	251308738	ODU SLF 18GHZ TR 1010 LO B1	17 685.0	17 985.0	1010
UFH18-1010-01-00	251308746	ODU SLF 18GHZ TR 1010 HI B1	18 695.0	18 995.0	1010
UFB18-1010-02-00	251308759	ODU SLF 18GHZ TR 1010 LO B2	17 930.0	18 230.0	1010
UFH18-1010-02-00	251308767	ODU SLF 18GHZ TR 1010 HI B2	18 940.0	19 240.0	1010
UFB18-1010-03-00	251308770	ODU SLF 18GHZ TR 1010 LO B3	18 180.0	18 480.0	1010
UFH18-1010-03-00	251308791	ODU SLF 18GHZ TR 1010 HI B3	19 190.0	19 490.0	1010
UFB18-1010-04-00	251308803	ODU SLF 18GHZ TR 1010 LO B4	18 400.0	18 700.0	1010
UFH18-1010-04-00	251308811	ODU SLF 18GHZ TR 1010 HI B4	19 410.0	19 710.0	1010
UFB18-1560-01-00	251308824	ODU SLF 18GHZ TR 1560 LO B1	17 700.0	18 000.0	1560
UFH18-1560-01-00	251308832	ODU SLF 18GHZ TR 1560 HI B1	19 260.0	19 560.0	1560
UFB18-1560-02-00	251308845	ODU SLF 18GHZ TR 1560 LO B2	17 840.0	18 140.0	1560
UFH18-1560-02-00	251308853	ODU SLF 18GHZ TR 1560 HI B2	19 400.0	19 700.0	1560

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SAGEM Model	Part Number	SAGEM Description	Transmit Range (1)		TR Spacing (MHz)
			Min Freq (MHz)	Max Freq (MHz)	
23 GHz ODUs					
UFB23-1008-01-00	251308866	ODU SLF 23GHZ TR 1008 LO B1	22 000.0	22 314.0	1008
UFH23-1008-01-00	251308874	ODU SLF 23GHZ TR 1008 HI B1	23 008.0	23 322.0	1008
UFB23-1008-02-00	251308887	ODU SLF 23GHZ TR 1008 LO B2	22 286.0	22 600.0	1008
UFH23-1008-02-00	251308895	ODU SLF 23GHZ TR 1008 HI B2	23 294.0	23 608.0	1008
UFB23-1200-01-00	251308907	ODU SLF 23GHZ TR 1200 LO B1	21 200.0	21 530.0	1200
UFH23-1200-01-00	251308915	ODU SLF 23GHZ TR 1200 HI B1	22 400.0	22 730.0	1200
UFB23-1200-02-00	251308928	ODU SLF 23GHZ TR 1200 LO B2	21 490.0	21 820.0	1200
UFH23-1200-02-00	251308936	ODU SLF 23GHZ TR 1200 HI B2	22 690.0	23 020.0	1200
UFB23-1200-03-00	251308949	ODU SLF 23GHZ TR 1200 LO B3	21 780.0	22 110.0	1200
UFH23-1200-03-00	251308957	ODU SLF 23GHZ TR 1200 HI B3	22 980.0	23 310.0	1200
UFB23-1200-04-00	251610993	ODU SLF 23GHZ TR 1200 LO B4	22 070.0	22 400.0	1200
UFH23-1200-04-00	251611031	ODU SLF 23GHZ TR 1200 HI B4	23 270.0	23 600.0	1200
UFB23-1232-01-00	251308960	ODU SLF 23GHZ TR 1232 LO B1	21 200.0	21 500.0	1232
UFH23-1232-01-00	251308275	ODU SLF 23GHZ TR 1232 HI B1	22 432.0	22 732.0	1232
UFB23-1232-02-00	251308283	ODU SLF 23GHZ TR 1232 LO B2	21 472.0	21 786.0	1232
UFH23-1232-02-00	251308296	ODU SLF 23GHZ TR 1232 HI B2	22 704.0	23 018.0	1232
UFB23-1232-03-00	251309003	ODU SLF 23GHZ TR 1232 LO B3	21 779.0	22 093.0	1232
UFH23-1232-03-00	251309011	ODU SLF 23GHZ TR 1232 HI B3	23 011.0	23 325.0	1232
UFB23-1232-04-00	251611065	ODU SLF 23GHZ TR 1232 LO B4	22 086.0	22 386.0	1232
UFH23-1232-04-00	251611094	ODU SLF 23GHZ TR 1232 HI B4	23 318.0	23 618.0	1232

26 GHz ODUs					
UFB26-1008-01-00	251309024	ODU SLF 26GHZ TR 1008 LO B1	24 549.0	24 949.0	1008
UFH26-1008-01-00	251309032	ODU SLF 26GHZ TR 1008 HI B1	25 557.0	25 957.0	1008
UFB26-1008-02-00	251309045	ODU SLF 26GHZ TR 1008 LO B2	24 945.0	25 345.0	1008
UFH26-1008-02-00	251309053	ODU SLF 26GHZ TR 1008 HI B2	25 953.0	26 353.0	1008

38 GHz ODUs					
UFB38-1260-01-00	251309066	ODU SLF 38GHZ TR 1260 LO B1	37 044.0	37 632.0	1260
UFH38-1260-01-00	251309074	ODU SLF 38GHZ TR 1260 HI B1	38 304.0	38 892.0	1260
UFB38-1260-02-00	251309087	ODU SLF 38GHZ TR 1260 LO B2	37 604.0	38 192.0	1260
UFH38-1260-02-00	251309095	ODU SLF 38GHZ TR 1260 HI B2	38 864.0	39 452.0	1260

Note 1 : These frequencies correspond to diplexer bandwidth, i.e. not channel center frequencies. The minimum and maximum channel frequencies depends on the selected channel occupied bandwidth. The lowest available channel center frequency is the minimum diplexer frequency plus the half channel bandwidth, while the highest available channel center frequency is the maximum diplexer frequency minus the half channel bandwidth.

Channel occupied Bandwidth is 20 MHz for a 28 MHz Tx/Tx spacing, 10 MHz for a 14 MHz Tx/Tx spacing, 5 MHz for a 7 MHz Tx/Tx spacing and 2.5 MHz for a 3.5 MHz Tx/Tx spacing

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